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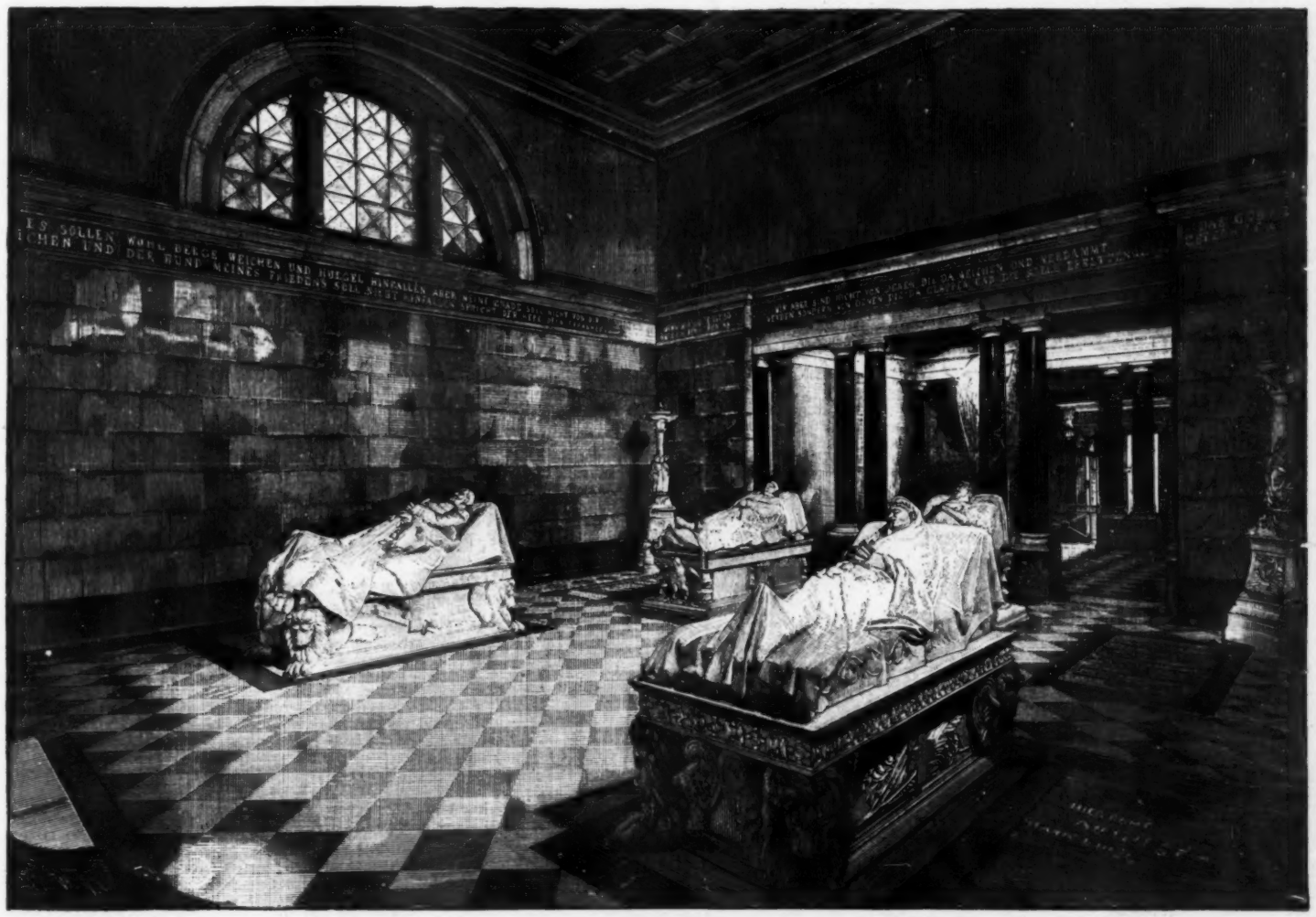
THE ENLARGED MAUSOLEUM IN THE PARK OF THE PALACE AT CHARLOTTENBURG.

In the park of the palace at Charlottenburg a quiet reigns that is like the quiet of grief. Of course nature does not grieve, but we men attribute to her the same feelings that affect us. On this spot where an exciting drama has been played, where the hero of Weissenburg and Wörth suffered mortal agony with heroic courage, and where Prussia's King Frederick William III., with his Queen Louisa, the bright star of German women, and the first emperor and empress of united Germany sleep their last sleep, one's thoughts turn to the transitoriness of all that is earthly to that stern law that overpowers even the noblest and best.

At the end of a path darkened by immense fir trees that roof it over, the little structure is visible with its portico and pillars of red granite. As it stands there quiet, peaceful and isolated from the world, it forms a sanctuary sacred to the hearts of all Germans. One who is approaching would not know that the building had been enlarged, because no important change has been made in the front, and this is as it should be, for anything on which the affections of the nation have so long been fixed should be piously preserved. On account of this strong feeling, no very considerable enlargement has been undertaken.

SARCOPHAGUS OF EMPEROR WILLIAM I. IN THE ENLARGED MAUSOLEUM IN THE PARK OF THE PALACE AT CHARLOTTENBURG.

This is the second time that the mausoleum has been enlarged. It was built in 1810 by Court Architect Gentz, the temple then consisting of a portico and a little room back of it that was lighted by a violet overhead light, and in the center of which stood the sarcophagus of Queen Louisa, the work of Rauch. After the death of Frederick William III., in 1840, the first enlargement was made by Court Inspector of Buildings Hesse, who added a large hall with an apse and a vault underneath, at the rear of the little inner room, where the sarcophagus of the king—also made by Rauch—as well as that of the queen were placed, and where services in memory of the dead could be held. The coffins remained in the vault under the old room, their resting places being indicated by two marble tab-



THE MAIN HALL IN THE ENLARGED MAUSOLEUM AT CHARLOTTENBURG.
(From photographs by Hermann Rucheardt, of Berlin-Gross-Lichterfelde.)

lets bearing inscriptions. The mausoleum retained this form for nearly fifty years, but in January, 1889, work was begun on the second enlargement, from designs and under the direction of Court Inspector of Buildings Geyer; and on March 9, 1890, all was finished. By pushing the rear wall and the apse out about 18 feet, a considerable enlargement of the main hall and the vault under it was attained. The Princess Liegnitz, the morganatic wife of Frederick William III., and Prince Albrecht, the king's youngest son, were buried in this vault.

The style of the exterior of the building is of the severe early Doric. The only noticeable change is that a half-round window has been substituted for the five small united windows on each side, and the wall has been covered with beautiful Silesian sandstone, the socles being of polished red granite. The solemn structure stands under the high trees of the park as plain and simple as at first. In the pediment of the portico are the letters alpha and omega in gold. Let us enter. Two flights of marble steps, between which are the steps leading down to the crypt, lead into the first room, with the violet overhead light. The two tablets in the floor have disappeared and their places are filled by black and white lozenge-shaped blocks. In the center of this chamber there is a gigantic figure of an archangel in the character of St Michael (modeled by Prof. Encke), guarding the crypt. This immense figure stands there looking proud and bold, clad in armor, with his long mantle thrown back, his shield on his muscular left arm, and grasping his raised sword in his right hand. The stern and warlike attitude of the winged guard is the more appropriate as he stands before the graves of the monarch and his consort during whose lives the greatest wars of the century occurred.

Beyond the archangel the eye catches a glimpse of the main hall, between the pillars of black marble veined with gold. There, from the rear wall, opens the apse with the dome picture by Pfannschmidt, painted in light colors on a gold ground, and representing the throned Christ blessing the king and queen, who are kneeling at his feet. The white marble altar stands on a base of the same beautiful material in the apse, and above this is Achermann's marble crucifix. At the sides of the communion table are beautiful marble candelabra, the work of Rauch and Fr. Tieck, one of which is decorated with the three Fates, and the other with the Hours.

The two beautiful sarcophagi, by Rauch are nearer to the smaller room, with their feet toward the altar, and the inscription tablets above referred to are placed beside these monuments in the black and white marble floor. Between these sarcophagi and the wall of the apse are the marble sarcophagi, also modeled by Professor Encke, for the deceased emperor and empress. Instead of employing the classical severity of Rauch, this artist has treated the figures more freely.

The emperor, in the uniform of the first regiment of foot guards, rests on a pall that falls in folds and is edged with a border of laurel. His figure is nearly covered with the heavy ermine mantle which hangs down over the edge of the sarcophagus in heavy folds, but is laid back from the breast just far enough to show the rich order decorations. His folded hands rest on the sword of the realm and the well-earned laurel. Holy rest, deep peace, and true worthiness are expressed on his sleeping features, leading the observer's thoughts from dissolution and annihilation to eternal life. The figure of the empress is enveloped in a long widow's veil. Her hair is decorated with a diadem and a golden myrtle wreath, the latter as an allusion to her golden wedding. Her head is slightly inclined to one side, and in her folded hands she holds the cross and passion flower and leaves. The corners of the sarcophagi on which the figures rest are decorated with half figures of winged lions, and on the long sides are suitable reliefs; on that of the emperor the tokens of war—the helmet, sword, and torch—as well as those of peace—the tournament helmet, distall and hammer, with laurel and oak leaves; on that of the empress, the communion cup and the red cross, on crossed palm and laurel branches. There are inscription tablets in the floor at the sides of the sarcophagi.

The great hall, with its lights and costly marble decorations, make a fine, solemn impression. Broad beams of light fall through the windows on the shimmering stone. Gray Silesian and white Carrara marble cover the walls, but overhead there is a beautiful coffer or sunk panel ceiling in white and blue, with silver and gold. Scriptural texts in gold lettering decorate the walls.

Let us return to the portico and descend to the crypt. The two niches in the first room are empty, but in the new room, which has been enlarged into a long hall with three naves, we find the shrines of the dead.

The architecture of the crypt is strikingly appropriate. A flat arch resting on four pairs of pillars of polished red granite spans the middle nave, at the end of which is the apse with its black marble altar. The gray green color of the plaster on the walls harmonizes well with the serious tone of the room, which is dimly lighted by side windows.—Illustrirte Zeitung.

THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.

AT a recent meeting of the Royal Institute of British Architects, "The Architecture of China," a paper by Mr. Frederick M. Gratton, was read. For the following abstract we are indebted to the Builder, London.

There are, in China, cities of four classes: those of the first rank termed Foo, the second Chow, the third Ting, and the fourth Hsien. In ancient China the number of foos amounted to 159. At the present time there were said to be 1,281 cities encircled by high crenellated or embrasured walls, averaging from 25 ft. to 30 ft. in height, sometimes flanked with towers. They were of stone, of brick with stone or granite bases, or with stone or granite facings; substantial structures of carefully prepared and good material. Among these cities were Pekin, the present yellow capital; Nankin, previously the capital of the empire; Hangchow, also formerly the imperial capital, and of great historical interest; Soochow, the "City of Beauty and Pleasure," the Paris of the Chinese; and Canton, one of the first cities of ths empire, with walls some 20 feet thick, and varying from 25 feet to 40 feet in height.

Shanghai was a hsien, with brick walls three and three-quarter miles in circumference, and seven gates. There was an immense suburb outside the walls. Several cities, like Cheng-tu (foo), the capital of Szechuen, were clean and in good preservation, with wide paved streets, and in all respects fine cities, hives of industry and centers of trade; while others were evil smelling places, with narrow alley-ways and dense populations.

An exceedingly rare example of a three-storied erection was the "City Temple of Soochow." Some of two stories in height were still to be found; but by far the larger proportion were lofty one-storied buildings, with massive open-timbered roofs, originally dedicated to the service of individual deities, but now employed in a mixed worship of the triumvirate of Buddhist, Confucianist, and Taoist divinities. The general plan was of three buildings, or halls, parallel with and behind one another, each entered through the other, the third being the largest and most important. The workmanship was solid, with a plethora of ornament. The approach was often by fantastic bridges or massive flights of steps and handsome gateways.

Magnificent temples and shrines had been erected in the imperial capitals. Of these might be mentioned the Temples of Heaven and Earth at Pekin, each in a square, park-like, walled inclosure of some three miles circuit. The former contained the north and south altars; circular, roofless, terraced platforms, incased in white marble. The northern altar was in three terraces, diminishing from 120 feet to 60 feet, each surrounded by a marble balustrade. The platform was approached by eight triple flights of nine steps each, and carried the circular fane dedicated to the "Queen of Heaven." The roof, rising in three pagoda-like heights covered with glazed tiles of a lovely cerulean blue, was open timbered, giving view to the highest point of the gilded interior. The main and second roofs were supported by twelve elaborately decorated columns, and the highest one by four pillars. Midway between the two altars stood the circular tower containing the tablets, also roofed with blue tiles, the window openings filled with blue glass rods, which produced a dazzling effect in the sunlight. The southern altar was very similar to the northern, its approach being spanned by two sets of three beautiful white marble memorial arches (Pei loh). The Temple of Earth was in many respects like the Temple of Heaven, save that the predominating decorative color employed was green, and that it was much simpler in style and adornment, the altar being square. Temples were also erected to light, and to the sun and moon. To judge from the records, these temples must have been marvels of beauty in the day of their prime. Several buildings had been considerably damaged by fire in recent years.

The Yung-ho-Kung, or great Llama Temple, in the Tartar City, was roofed with brilliant yellow glazed tiles. The entrance was adorned with animals carved in stone, and the interior almost covered with innumerable carvings of birds, beasts, men, etc. In the main hall stood an enormous wooden figure of Buddha, some 70 feet in height, colored to imitate bronze. There were, besides, the "Imperial Ancestral Temple," and the Tai-miaou or Imperial and National Temple, in Pekin.

What were called by the Chinese "beamless" temples might be seen near to the Ming Tombs at Nankin, at Soochow, and a few other places. They were stone and brick structures of considerable size, with parallel walls forming several chambers, and covered with brick barrel vaulted arches. Some were now little more than ruins; others had many arches still standing after surviving centuries of neglect; there was an entire absence of wood in their construction. They were said to have been erected about the eleventh century A. D., during a period of great Buddhist fervor, as fire-proof repositories for archives and relics.

In regard to palaces, but few remained. The celebrated Yuen-Ming-Yuen, or Summer Palace, was a gem of art. It covered about twelve square miles, and contained some thirty distinct residences for the emperor, ministers, eunuchs, servants and others. Passing through the grand portal into the paved courtyard, the great reception hall, or hall of audience, 120 feet long, 42 feet wide, and over 20 feet high, in all the glory of its gilding, painting, and carving, met the eye, erected upon a granite platform surrounded by a peristyle of wooden columns, with graceful roof and elaborately fretted eaves. Facing the central door was the emperor's carved ebony throne on a marble-tiled floor. Here were grouped all the royal luxuries that an eastern mind could conceive; while pleasure grounds, buildings, rockeries, lakes, grottoes, in almost bewildering plenty, occupied the vast and magnificent park-like domain, the private suites of rooms of the emperor and empress, containing all that was lovely, attractive, and picturesquely fantastic in Chinese art. Such was one of China's palaces at the time of the Anglo-French invasion, but barely spared from the general wreck of much that could claim architectural merit in her capital.

Pagodas were constructed of various materials, from wood to cast iron, and mention was made in Chinese records of some of white marble and copper. They varied from three to thirteen stories in height, nearly always, however, consisting of an odd number, and usually pyramidal in contour. Some were solid, with no interior chamber, others hollow; the larger ones of the latter class contained, instead of an altar, a smaller pagoda inside the larger structure. One of thirteen stories existed at Pekin, 275 feet 5 inches high, the figures being formed of moulded brick. The Peh-ta-sze, or White Pagoda Temple, erected in 1100, and rebuilt in 1819, was said to have had the appearance of jasper, and contained 2,000 clay models of pagodas, besides images, its most conspicuous feature being the great copper umbrella-shaped top.

The porcelain tower of Nankin was originally designed of thirteen stories, only nine of which were executed; it was commenced in 1412, and took twenty years to complete. It stood on a raised platform, and mounted to a height of about 250 feet. It was octagonal in plan. The general effect was described by a Chinese writer as having been of dazzling brilliancy; the predominant color was green, and it was one of the best examples of its class. It contained about 2,000 images, and had 150 bells pendent from the roof. It was destroyed by the insurgents in 1856-57, and was an irreparable loss to the country.

Some so-called pagodas might be better called towers. Those of Wuchang and Pekin were curiously shaped structures, with a much greater approach to domestic than religious origin and uses. The summer houses and garden pavilions were also pretty and attractive to a degree.

In regard to memorial arches and gateways, the Pei-loh (often misnamed triumphal arch) was a memorial arch or gateway, sometimes comparing closely with its probable ancestor, the Toran of India, and their offspring, the Torii of Japan. Some were solid and massive erections, while others consisted of perpendicular shafts of granite, stone, marble, or wood, with horizontal ties; or, as in the more elaborate examples, with enriched entablatures, covered with projecting roofs at various levels; often with several spans in a row. They were often elaborately pierced and sculptured, richly ornamented with bass-reliefs and inscriptions, the harmony of coloring rendering the effect greater than could be readily described.

The mausolea and tombs of the emperors and grandees were imposing resting places. The Ming Tombs, now in ruins, near Pekin, had been elaborately described by various authors. The spacious roadways or avenues of approach to these sacred precincts were usually lined with colossal figures in stone or granite monoliths, of elephants, camels, lions, dogs, horses, mythical animals, and men, in successive pairs at regular intervals—the approach to the Ming Tombs having thirty-two pairs of these images, the largest about 12 feet in height.

The principal highways of China being her navigable rivers and canals, the number of bridges was legion. Suspension bridges of rude form, and with but the barest elements of engineering skill, appeared at intervals in various parts of the country; but by far the greater proportion were those with flat spans and piers, or arches of varying shapes, built of stone, granite, marble, brick, or combinations of these materials.

The Wan Show Keaou, or bridge of "Ten Thousand Ages," at Foochow, in the province of Fokien, was one of the best known and most celebrated of the flat-spanned variety. The bridge was nearly 2,000 feet in length and 14 feet in width; the roadway, of solid blocks of gray granite, resting on piers of the same material.

A bridge near Pekin, commonly termed the "Marble Bridge," was of seventeen stone arched spans, the roadway being protected by white marble balustrades. The nine arched marble bridge near the same capital was more legitimately entitled to the name, as marble was more generally employed in its construction. This was some 600 feet long.

The majority of the arched bridges of China were of stone or granite. The voussoirs, instead of being thick blocks of stone with radiating joints, were generally of thin curved or shaped slabs laid lengthwise with the arch, the slabs often measuring 4 or 5 feet in length, by a couple of feet wide, and some 6 or 8 inches thick. Alternating with these long courses were narrow voussoirs at right angles to the slabs, keyed into the masonry backing.

Long before the Greeks or Romans understood the properties of the arch, it was known and employed in China.

The chairman said there could be only one opinion about the importance attaching to this subject. Architects were all more or less travelers, but he did not believe that many of them had been in China, and passed through the gates of Pekin. At the same time, he was sure that some of them had noted the peculiarities and characteristics of that very remarkable people, the Chinese, and had seen in their methods of construction many things which were not only of interest to them, but which must have exercised an influence on the architecture of other countries.

Professor Aitchison proposed a cordial vote of thanks to Mr. Gratton for his paper, and to Mr. Kidner for kindly reading it. As had been remarked, they were judges, or students at any rate, of all the architecture which the world had seen, and they were greatly in want of it, for while almost every country had produced a style of its own, this country had yet to take that step.* He hoped, however, it would not be long before they did that, considering that they had the whole world before them, and that a large proportion of the members present had traveled in different parts of the earth. He envied Mr. Gratton the opportunities he had had of seeing the splendid way in which the whole of the interiors of the temples and other buildings of China were colored, and it was of the things they would all look forward to seeing introduced into England more than it had hitherto been. It was sad to think that the parsimony of our government prevented the great discovery of the palace of Darius at Susa being made by an Englishman. The consequence was that the Louvre now possessed some of the splendid friezes done in glazed bricks. The French, too, with the aptitude of artistic skill which distinguished them, immediately set to work, and at the last exhibition at Paris almost all the roofs were clearly animated by the lessons they had learned from that monument of color in Persia. He wished the paper had given them a little more account of the charming lighting which was carried on by a lamina of oyster shells.

Until the introduction of glass at a low rate, very few openings were glazed. The few that were glazed in old times—as he had seen in out-of the-way places in Italy—were glazed with parchment, while others had shutters, pierced not like the ornamental ones, but simply with bars put together into patterns. They were very much indebted to Mr. Gratton for his interesting paper, and also for the photographs shown on the wall; and he hoped at some future time they might have drawings of the colored temples which the author had seen.

Sir Henry Howorth, in seconding the vote of thanks, said the subject contained many points of interest. He could not help thinking that English architects

* What about English Gothic—the Early English and Tudor styles especially?—ED.

might sometimes well take a few lessons from the Chinese. When one saw changes in the shape of the buildings and their ornamentation, it was certain that there had been contact with some other race and civilization which had brought East and West together, and had diverted the whole course of construction and ornament into an entirely different line. For instance, the astronomical constructions at Pekin, which were shown on the wall, were designed by the Jesuits for the Chinese emperor. Going further back, it would be found that Persian workmen, who went into China in 1260, introduced the making of blue and white china, for what was termed the blue Nankeen china was a product absolutely unknown before that period.

The Chinese quickly adopted this, and the beginning of the blue and white Chinese porcelain dated from that time. Then, again, some of the towers, which, undoubtedly, were copies of wooden architecture, were, he believed, imported into China by the Buddhists from India, in the sixth and seventh centuries. He agreed with M. Dieulafoy, that the earliest civilization of China came from the West, and among other things the art of making bricks, which were made of curious sizes and shapes, and were distinctly imitations of those found in the ruined mounds of Elam and Mesopotamia. The pagodas with many stories had been primarily copied from the pyramidal buildings found in Chaldea, and were one of the many proofs that the early civilization came from that direction.

Mr. R. Phené Spiers said that though he had never been to China, he had inspected the photographs with great interest. Many of them were quite unknown to him, and he had been struck with one of the first parts of the paper—referring to the resemblance to Chaldean and Babylonian structures. What Sir Henry Howorth had said had rather shown him that the resemblance was not accidental, but was possibly due to the fact that in the very early days of China there must have been some connection between the two countries.

It was possibly from Chaldea that the Chinese had derived their great knowledge of astronomy at various times, and what had been said by Mr. Kidner as to the existence of enormous portions of agricultural land in these great cities reminded one of Babylon, the length and breadth of which appeared to have been so immense that one could only imagine that the greater portion of it must have been occupied by agricultural land for the support of the inhabitants in case of a siege. One point, however, he had been looking for in vain in the paper. The paper was about the architecture of China, and the question which came nearest to them now was whether there was anything in that architecture which gave it a real claim to being a style. One could not help being struck with the massiveness and beauty of some of the structures exhibited on the walls. There was a representation of a gateway with three arches, of which he possessed a copy, and he had often admired the simplicity of the lines and the construction. It was immensely suggestive, as having some principles worthy of copying or imitating. He was speaking of the massive construction of the lower portion of the gateway, and, until he had seen this photograph, he had no conception that the Chinese had ever constructed buildings with such constructive features, those of so many of their other buildings being of a merely ephemeral character. There was no doubt that the pagodas and temples were built as described in bamboo for certain reasons. The material of bamboo was of such a nature as required it to be used without its being squared; therefore, while all our timber was at once squared and wrought, the bamboo must not be touched. It was no doubt due to this that the Chinese system of construction was of a totally different character to anything to be found in this country. The system of putting a series of beams one above the other, and supporting the tiling at the end, was a scheme of construction of which the people of this country had no knowledge. It had been suggested that the Chinese had better adopt our system of trussing, but with the bamboo that would be impossible; moreover, they had evolved a system which was better for their construction. There was another point which would appeal to all architectural students. If there was any detail which attracted more attention and to which they attached more value as judging of style, it was that one magnificent feature which we called the capital. Now the Chinese had never adopted that feature, and that was one very great want in their style.

Mr. Gratton had said little about one very interesting subject, that of the beamless temples. They wished to know what the arches of these were and how they were constructed. The description given of these was almost akin to that of the famous granaries of Rameses II., which had brick vaults, with construction of a peculiar kind. They were all built flatwise and laid in sloping rings, without centering, which was an important characteristic of the Babylonians, the system of laying arches flat being a Babylonian system of building. The flat brick laying up against the previous structure was sufficient to retain it in its position until all the voussoirs of the arch were built. That showed that the Chinese either learned or found out at some period the method of building arches without centers. As Mr. Gratton had again gone out to China, it would be interesting if he would turn his attention to some of the simpler brick construction of the country, to see if he could ascertain the earliest methods adopted there.

Mr. H. S. Ashbee wished he could have heard this paper before he went to Pekin, or, better still, could have had the guidance of the author. As an outsider, one could not fail to be struck by the marvelous architecture of that very remarkable country, but much explanation was needed before one could thoroughly appreciate it. He did not think, however, that the buildings to be found in China could be all adapted to our way of living or to our state of civilization. The disposition of the city of Pekin was so remarkable that a few words on the subject might not be out of place. Pekin consisted in reality of four cities, the one being inside the other. There was, first, the palace and gardens of the emperor; around these were the villas of the high authorities; then came the city of the soldiery, in which were situated the embassies and the one hotel; while outside all again was the Chinese city—each being shut off from the other by walls, with gates closed from sundown to sunrise. The Hall of Examinations at Pekin contained nothing remarkable from an architectural point of view, but the system of the whole thing was peculiar. Each student was shut up during the examination in his little cell, the doors being closed, and he not being allowed egress until the examination was over. The student was not allowed to take any books with him; his food was passed in, and should he die during the time of the examination his body was taken out through a hole in the wall. There was another curious thing in China which had more or less to do with architecture, viz., the House of the Dead. When any one died, especially if he were a man of position, he was not at once buried, but a sort of chamber was hired for him in the House of the Dead, and there he was surrounded by representations of what he had loved during life. He had frequently seen the dead bodies surrounded thus with imitation piles of gold or the figure of a favorite servant or horse.

Mr. Emerson remarked that Mr. Gratton had mentioned some statues of Buddha 70 feet in height and colored to represent bronze. He would like to know the material these were made of.

Mr. Kidner replied that he believed these were made of plaster. Outside Yokohama there was a statue made actually of bronze, 70 feet or 80 feet high, cast in different pieces, and all riveted together, but the various figures of Buddha he had seen in Chinese temples had been chiefly of plaster made in imitation of bronze.

Mr. W. Simpson contributed some notes on Mr. Gratton's paper, in the course of which he remarked that Mr. Gratton's account of the Chinese guilds would be a surprise to those who never heard of them before. The plan of the Buddhist temple, which was also a monastery, bore a slight resemblance to the rock-cut viharas of India, and yet the Chinese arrangement of an ordinary house plan predominated. The "beamless temples" were new to him, and were, he thought, an exception to the usual Chinese mode of building; and Mr. Gratton's description of them suggested the question as to whether they might not have been a rude imitation of the Indian Buddhist Chaitya cave. Mr. Gratton had said that they were constructed "during a period of great Buddhist fervor." The Yang and the Yin were referred to only as a decorative form. They were, he (Mr. Simpson) believed, far more than that in Chinese architecture. The great Temple of Heaven, in Pekin, was circular in form, because it symbolized heaven, or Yang; the Temple of Earth, again, was square in plan, as the earth was Yin. Even the common mound over graves, such as were seen around Shanghai, were, when new, and not changed by the action of the weather, formed with a square base, which was Yin, and upon that was a dome of earth, which was round to represent the Yang.

As to the question of thirteen-storied pagodas in China, he thought there need be no doubt as to the number; the northern examples about Pekin had merely roofs in place of stories, and the Pa-li-chang Pagoda at Pekin had thirteen. Mr. Gratton had referred to the Tung-Chow Pagoda, which had also thirteen stages. A pagoda with thirteen rooms, one over the other, would be a huge pile, and not likely to be often repeated, but the instances given showed at least that there was no objection to the particular number. Mr. Gratton did not venture on the tent theory for the origin of Chinese roofs. Mr. Simpson mentioned that in a former paper of his, read before the institute, another theory was suggested, which still appeared to him as far more likely to explain the curves in Chinese roofs than the "tent theory." That is that the form was the result of having used bamboos, or, it might be, some other wood that was liable to bend from weight being put upon it. What was known as the Bengal "thatched roof" was, they knew, produced in that way, and it gave birth to certain curved lines which were recognized as beautiful in Indian architecture, and these forms were now repeated in stone and marble. It was in keeping with their experience that architectural forms resulted from the materials used in construction, and this theory would be in accordance with that experience, while the tent theory would be entirely opposed to it. If any one could work out the meaning and origin of the complicated system of brackets which formed what he might be allowed to call the architrave of a Chinese building—because the brackets come between the transverse beam and the roof—this peculiar construction, if it were explained, might throw some light on the first beginnings of the Chinese roof.

SARCOPHAGUS OF THE EMPRESS AUGUSTA IN THE ENLARGED MAUSOLEUM IN THE PARK OF THE PALACE AT CHARLOTTENBURG.

A DUTCH CO-OPERATIVE TOWN.

AGNETA PARK, which stands on the outskirts of the little town of Delft, in Holland, exhibits the pleasantest phase of one of the most interesting of all the various attempts that have yet been made to secure a solution of the labor problem, says the London Times. With the Park itself the most prosaic of visitors cannot fail to be charmed. It is some ten acres in extent, and is divided into two parts by a stream of water which broadens in the center into a lake, bridges maintaining the connection between the two sections. That on the left is well wooded, while that on the right is devoted to flower gardens, recreation grounds, and more especially to dwellings, alike for employers and employed, who live here together in a manner quite patriarchal, amid surroundings almost idyllic in their aspect.

The largest of the houses is that of the managing director of the adjoining Netherlands Yeast and Spirit Manufactory, while the smaller houses—constructed with separate entrances, to accommodate two, four or six separate families, as the case may be—are occupied by the workpeople.

There are one hundred and fifty of these smaller houses, arranged in "streets" or terraces, or as detached or semi-detached dwellings, between which one gets glimpses of a thoroughly characteristic Dutch landscape in the background. Each has its bit of garden, which is often gay with flowers, and as there is an abundance of trees in every direction, the general effect is pleasing in the extreme.

The total population of the Park is, children included, about four hundred; but a considerable number of the employes live elsewhere, owing to lack of accommodation for all of them or other reasons. It is, literally, only a stone's throw from the larger house to the smaller, and the "rounds" are as much those of the workmen's houses as they are those of the more pretentious dwelling of the managing director. Near to the lake is an open space, in the center of which is a well constructed band stand, where an orchestra, manned by the workmen themselves, performs twice a week in the interests alike of the community and of any of the townspeople who care to listen to the music and wander about the promenades which the Park offers.

On the lake, boating goes on without seriously disturbing the swans which have their habitat there; and elsewhere one finds playgrounds with swings, etc., for the children, and a "summer casino," bowling alleys, and archery grounds for their elders. But especially one remarks a large building, known as the "Community," which forms the center point of the "life" of the Park. Here is a hall that can be used for festivals, balls, lectures, exhibitions, concerts and meetings, being capable of seating 1,200 persons, though it is generally divided by partitions so as to form a reading room and a gymnasium. Then, too, there is a variety of smaller rooms used for a kindergarten for the juvenile residents of the Park, for evening classes and for various educational and other purposes. Space is also found for a library of four thousand volumes.

Friendly gatherings of all sorts take place here, from the annual "Festival of Labor and Brotherhood," each 30th of July, to magic lantern entertainments for the young people. Still another feature of the Park

is its co-operative stores and bakery, which are available not only for the resident population, but for ordinary dwellers in the locality as well.

Agneta Park owes its establishment to Mr. Van Marken, the managing director of the Netherlands Yeast and Spirit Company, founded by him in 1869. That gentleman has ideas of his own concerning the relations which should exist between employers and employed. He believes that the conditions under which workmen live may have a great effect on their development, both personal and as workmen, and that it is to the direct interest of those who employ them to see that they are provided with "homes" in the truest sense of the world—homes, that is to say, which will not only fulfill every requirement of sanitary laws and convenience, but be positively attractive in themselves.

The matter is thus regarded by him as one of more than mere philanthropy. In fact, in all that he has done for his workpeople, Mr. Van Marken discards any motive of "philanthropy," and seeks to look at everything from a business or a common-sense point of view. "The moral and material improvement of the workingman," he holds, "must increase alike his zeal and his strength, and hence confer a practical benefit on the employer." Having these and a variety of other ideas on the subject of workingmen's homes, and finding that the dwellings available in the town of Delft were not what he thought they should be, he bought, in 1884, the site of Agneta Park, and had it laid out and the various buildings erected on it.

But his idea was that the whole should eventually become the property of the community. Hence, having purchased the land, he formed a limited liability company, with a nominal capital of 160,000 florins, and himself bought from the company three hundred and twenty shares for 32,000 florins. He then sold the land to the company for 29,000 florins, the amount he actually paid into the company's exchequer, in addition to transferring to them the site for the Park, being thus 3,000 florins, which formed the working capital. The money for erecting the dwellings, etc., was raised by mortgage on property which, at the time, was really non-existent, so that a certain degree of confidence had to be shown in the matter.

The rents are now paid into a common fund, which is so arranged that, after the deduction of certain proportions for payment of interest and for gradually paying off the mortgages, there is a balance left, which is apportioned among the dwellers in the houses, according to the amount of their rent, and is devoted to buying up the shares in their names. In this way it is calculated that in the course of about thirty years the whole of the original cost will have been cleared off, and the Park, with the dwellings on it, will be held by the community, owing to the gradual transfer of all the shares into their own hands.

When that condition of things arrives, the householders will still pay their rent, as at present, but they will receive it back in the form of dividends on the shares held. This arrangement is thought to be an improvement on the ordinary building society notion of enabling a man to become his own landlord. The possession of a house of one's own may have its attractions, but it is regarded as bringing trouble and inconvenience as well, more especially in the case of a workman who may wish to remove to another town, or of one who dies and leaves, perhaps, his widow to dispose of the house as best she can. In each instance there is involved not only the question of inconvenience, but of the payment of law expenses as well.

By making the Agneta Park houses the property of the community as a whole instead of the workpeople as individuals, these drawbacks are avoided. When a tenant leaves, or dies, his share is disposed of through the directors to some other tenant, and he or his widow will receive the full value of it without any trouble and without any deductions on account of legal expenses. It is, also, to the interest of the community as a whole to see that no particular tenant neglects his property, or becomes a source of annoyance to others, as he might do if the house he lived in were actually his own. Thus it is claimed that under the Agneta Park system there are all the advantages of a workman becoming, in course of time, his own landlord, and none of the disadvantages, either to himself or other people.

CONFECTIONERY RECIPES.

GREENGAGE TABLETS.

Crushed sugar	14 lb.
Glucose	3 lb.
Tartaric acid	1 oz.
Water	2 qt.
Green coloring.	
Greengage flavoring.	

Melt the sugar in the water, and bring to a sharp boil. Add the glucose and let the boiling continue up to a strong crack degree. Pour out on an oiled slab and add color to make the batch a pale green tint. Mould in the acid and flavoring, and, when sufficiently cool, pass the batch through the large tablet rollers.

MUSK DROPS.

Crushed sugar	14 lb.
Tartaric acid	1 oz.
Cream of tartar	½ oz.
Water	2 qt.
Carmine coloring.	
Musk flavoring.	

Boil the sugar and water, and, after adding the cream of tartar, continue the boiling up to strong crack degree. Pour out the boiling on an oiled slab, and color the whole a pale red. Work in the acid and flavoring, and, when sufficiently cool, pass the batch through the acid drop rollers. After the goods are sifted, work some icing sugar among them.

EVERTON TOFFEE.

Crushed sugar	10 lb.
Brown sugar	4 lb.
Glucose	3 lb.
Butter	2 lb.
Water	2 qt.
Lemon flavoring.	

Dissolve the sugars in the water, bring the sirup to a sharp boil, stir in the glucose and continue the boiling up to strong crack degree. Break the butter to small pieces, drop them into the boiling sugar, add the flavoring, and pour out on an oiled slab, arranging the slab irons so as to make a level sheet half an inch thick. When partly set, mark the sheet deeply into bars or squares.

SWEET FLAG CANDY.

Crushed sugar	7 lb.
Cream of tartar	¼ oz.
Sweet flag infusion	1 pt.
Water	1 pt.

Wash and slice four ounces of sweet flag root, simmer it down to a pint, strain and add to the sugar. Add the water, melt the sugar, bring the whole to a sharp boil, then add the cream of tartar, and continue the boiling to soft ball; then remove the pan from the fire, rub portions of the sugar against the side of the pan until of a cloudy appearance; stir well, pour into buttered shallow tins and let cool, when remove the candy from the tins. In America this is a favorite remedy for dyspepsia and indigestion.

RUBY ROCK.

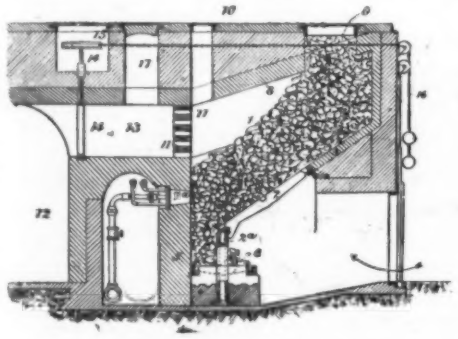
Crushed sugar	14 lb.
Glucose	3 lb.
Tartaric acid	2 oz.
Water	2 qt.
Cochineal coloring.	
Rose flavoring.	

After melting the sugar in the water, bring them to a rapid boil, then stir in the glucose. Continue the boiling up to a strong crack degree, and pour out on an oiled slab. Color half of the batch of bright red, work the acid, flavoring and a touch of blue into the remainder, and pull over the hook until of a glossy whiteness. Remove it from the hook, and pull it out to a sheet of irregular thickness, then roughly case the red with it. Pull out to long bars an inch thick, keep them in motion until cold, when chop into pieces of about an inch in length.—Confectioners' Union, London.

FURNACE FOR BURNING REFUSE MATERIAL.

By J. B. ALLIOTT and J. McC. C. PATON, Nottingham.

THE figure shows a sectional elevation of this destructor furnace in which 1 is the main combustion chamber, 2 the firegrate, the lower end of which is carried on a hollow bearer 2a, through which water is circulated to keep it cool. The lower grate 6 is of sufficient length to prevent clinker, etc., which fall on to it from the upper grate, from falling over its front end. The clinker, etc., remain on this lower grate until more completely burnt and partially cooled, when it is raked off over the front end. 7, 7a, and 7b are tuyeres through which air, in addition to that entering through the firebars, is forced; 7 and 7b, on either side of 7a, are not visible in cut; 3 is a drying-hearth on to which the refuse to be burnt is fed through the aperture 9. The stoking hole 10 permits the introduction of an iron bar for keeping the grate and back wall 5, from getting clinkered up. The products of combustion are drawn through the openings 11, 11, which are at the hottest part of the fire, into the main flue 12, through an intermediate chamber 13, fitted with a damper 14. Three modified forms of the destructor are also described. The claims made in a furnace of this kind are for the combustion chamber, having a hearth so inclined that refuse and clinker thereon will move downward automatically or with little help; for the fire grate, similarly inclined, and through which air is admitted to the combustion chamber; and for the back wall with inlet or inlets to admit air, to aid that admitted through the inclined grate; also an opening or space behind the back wall and the adjacent end of the inclined grate. Provisions for feeding refuse on to the upper grate, and for introducing air into the combustion chamber opposite to the feed end, as well as provision for the escape of products of combustion from the hottest part of the furnace, are further claimed. Finally, the intermediate chamber 13, as arranged, is claimed.



FURNACE FOR BURNING REFUSE MATERIAL.

PHOTO-MECHANICAL PRINTING PROCESSES.*

By WALTER E. WOODBURY, Editor the Photographic Times.

THE term "photo-mechanical" is applied to all processes in which, by the combined action of light and chemical substances, printing surfaces are prepared from which a number of impressions can be taken by purely mechanical means.

About the year 1813 Nicephore Niepce commenced a series of experiments which resulted in the discovery, some fourteen years later, that bitumen, under certain conditions, becomes insoluble when exposed to the action of light. He coated metal plates with a solution of this substance and exposed them to the image in the camera or beneath a drawing on translucent paper. Those portions acted upon by light became insoluble, while the remaining parts were dissolved away with oil of lavender. By this means a reversed picture in bitumen was obtained on the metal plates. By next applying an etching acid the parts of the metal unprotected by the bitumen image were corroded into the surface, and after clearing away the image a printing plate was obtained.

In 1838 Mungo Ponton discovered that gelatine and other organic substances, if treated with dichromate, became sensitive to light, becoming insoluble in those parts exposed, in the same manner as the bitumen. Later on (1853) Fox Talbot discovered another important property possessed by gelatine. If a dichromated film of this substance be dried at a moderate temperature and exposed to light beneath a negative, it could, when washed and dried, be treated in the same manner as a lithographic stone; that is to say, it would absorb water and refuse greasy ink in some parts, while in others it would refuse water and take up the ink.

It may be said that upon these three important discoveries all photo-mechanical printing processes are based. We can arrange them into two distinct classes:

A. Those in which the picture is moulded in pigmented gelatine.

B. Those in which the picture is printed in ordinary printing ink.

To the first class belong but three processes, which, except in a few minor details, are practically the same. They are the inventions of the late Walter B. Woodbury, and termed Woodburytype, Woodburygravure, Stannotype.

The second class contains a large variety of processes, including those printed from gelatine surfaces, from stone, from intaglio metal plates, and from metal plates in relief.

We will give an outline sketch of the various photo-mechanical processes as now worked.

Woodburytype was the invention of the late W. B. Woodbury. In this a glass plate is coated with collodion and then with dichromatized gelatine. This is exposed under a negative and afterward washed in warm water, which removes the soluble parts, leaving the image in relief. When the gelatine relief is dry it is exceedingly hard, and is stripped from the glass support and pressed into a sheet of lead by hydraulic pressure. By this means an intaglio mould is formed. This is placed in a specially constructed press having a heavy and perfectly true lid. A little warm gelatine solution containing any desired pigment is poured on to the intaglio mould previously greased; a piece of prepared paper laid on the top and the heavy lid brought down and clamped firmly. This squeezes out the excess of colored gelatine, only allowing that to remain which lies in the depressions of the mould, which sets and at the same time adheres to the paper support. The paper when removed has in this manner a gelatine image attached to it, which is dried and hardened with chrome alum. If glass be employed instead of paper, very beautiful transparencies or lantern slides can be made.

It will thus be seen that the resulting picture consists of varying thicknesses of pigmented gelatine, the tone or gradation depending upon the thickness.

The Stannotype Process is a modification of the Woodburytype by the same inventor. A negative relief is made, or the reverse of that used in the latter process, and developed upon a glass plate. When dry it is coated with a thin solution of India rubber and a piece of tin foil laid over it. The whole is passed through rubber-coated rollers, which presses the thin sheet of tin well into the relief, where it firmly adheres, owing to the India rubber solution.

Here we have to all intents and purposes a printing mould the same as obtained by pressing a positive relief into a lead plate, and the printing is done in the same manner. The object of the process was to reduce the cost of the necessary materials for the Woodburytype by dispensing with the hydraulic press.

Woodburygravure.—For some time the chief drawback to the use of Woodburytype prints for book illustrations was the necessity for trimming and mounting each picture. By a process discovered quite recently, it was found possible to mask the unsightly outside edge of each print and transfer the picture image from one support to another. It will be noticed in the Woodburygravure print that the surface is of a duller nature, more like a photogravure. This is due to the fact that the surface we see was previously the under part in contact with the first paper support.

The Photo Filigrane Process consisted in passing through a rolling press a gelatine relief and a sheet of heavy opaque white paper. Certain portions of the paper are, by the pressure, rendered more transparent than others, and a photographic image resembling a watermark can thus be obtained in the body of the paper.

Collotype or Albertype Process.—This process was devised by J. Albert, of Munich, in 1869, and is worked under a variety of fancy names.

A sheet of thick plate glass ground perfectly true is first coated with a film of albumen and gelatine to which a dichromate has been added. This is then laid on a piece of black cloth and exposed to light, washed and dried. The plate is again coated with a dichromatized gelatine, or isinglass, and dried in a chamber heated to about 120° F. It is then exposed under a reversed negative, soaked in water to remove all chromium salt, hardened with alum and finally dried. By this means a scarcely visible image in gelatine is the result, those parts which have been exposed to the light being insoluble and repellent for water, the remainder retaining their absorbent properties. The plate is fastened with plaster to the bed of an ordinary lithographic press, the printing being very similar. A wet sponge soaked in glycerine and water is used to moisten the absorbing parts of the gelatine (the whites of the picture) and an ink roller inks the image part. A paper mask is fitted over and a sheet of paper laid on it, and after pressure is applied, the ink is transferred to the paper. Prints may also be made upon cotton and silk fabrics.

Artotype Process is but a modification (by Obernetter) of Albert's process. Instead of first coating

* From the catalogue of the recent exhibition, New York, of the Society of Amateur Photographers.

with a chromated gelatine substratum and rendering insoluble to light, as a foundation, he uses a mixture of silicate of soda and albumen or stale beer. By this means metal may be used in the place of glass as the support.

Heliotype is another modification of the callotype process by Ernest Edwards, the principal feature being that the gelatine film is hardened with chrome alum and afterward detached from the support upon which it is first prepared. It thus forms a tough and flexible skin which can be used at any time for printing from by attaching to a zinc plate or to a cylinder.

Indotint Process.—Still another modification of the callotype process (by J. C. Roche). In this a copper plate is roughened by means of a sandblast, which causes the sensitive film to adhere closely. This is employed in place of the glass plate.

Collotype enamel prints, which have a very close resemblance to an ordinary silver print, are produced by employing a photo-brown ink, printing upon a tinted enamel paper, and afterward varnishing with a shellac water varnish.

Chromo-collotypes are produced with a number of collotype plates, using different colored inks, as in chromo-lithography. The negative having been made, it is blocked with opaque varnish in all parts, except those required to be reproduced in a certain color. From this a collotype plate is produced to be used with that colored ink. The varnish is then removed, and the negative blocked for another color, and so on. In printing, the paper is passed through with the different plates until all the colors have been printed on it, forming a complete colored image.

Instead of blocking out the negative, there are at present many processes of photographing the object, with specially prepared plates, through color screens which have the effect of shutting off or absorbing some colors while allowing others to pass through to the sensitive photographic film. This is more clearly explained in the three-color processes described later on.

Hydrotype is a kind of reversed collotype invented by M. Cros. A plate coated with dichromated gelatine is exposed under a positive transparency; the plate is washed and immersed in an aqueous dye. This is absorbed by the parts unaffected by light, and will yield a contact print by transference of the dye to a sheet of dampened paper.

Leimtype.—A process devised by Husnik, of Prague, in which gelatine images in high relief are used for direct printing in the ordinary printing press.

A thick plate of chromatized gelatine is exposed under a negative. This is then attached by means of gutta percha to zinc or wood. The surface is next developed by means of a solvent, usually an alkaline dichromate, which not only dissolves the parts unacted upon by light, but serves to strengthen the relief. This is not carried too far at first; the lights are then covered with an opaque ink, and the plate exposed a second time to harden and strengthen.

Photo-lithography.—The term includes a variety of processes in which the artist's drawing on the stone is replaced by a photographic image. In direct photo-lithography the polished stone is spread over with a solution of gum arabic and potassium dichromate. It is then dried and exposed under a negative. After this the stone is well washed and rolled in with ink.

The process which is almost universally employed is known as the "Transfer method." In this a sheet of paper* is coated with albumen or gelatine containing dichromate, which when dry is exposed under a negative and afterward coated over with a greasy lithographic transfer ink. The inked paper is floated face upward on boiling water, which coagulates the albumen. It is then washed with warm water, which removes the ink from the parts not acted upon by light. Where the light has rendered the colloid substance insoluble it retains its hold of the ink. The image in printer's ink is now termed a photo lithographic transfer, which is laid on the stone, and, when the two are passed through a press, the fatty ink image is transferred from the paper to the stone.

Photo-caustics.—This term is applied to certain photo-lithographic processes where the half tones are obtained by photographing the object or picture to be reproduced, through a ruled screen, as in the half tone process.

Chromo-Photo-Lithography.—Processes in which pictures are printed in two or more colors from different stones, the negatives being prepared as described in notes on chromo-collotypes and three-color printing.

Photo-Electrotypes.—A very large number of processes come under this heading. They all consist, practically, in first exposing a sheet of chromatized gelatine under a negative. If half tone effects are to be produced, grained or lined negatives must be employed. The effect of the light shining through the negative is to render certain parts of the gelatine film insoluble and incapable of absorbing water. After exposure, the gelatine is either soaked in water to swell the remaining soluble parts, or it is treated with a warm water bath, or acetic acid to wash them right away, leaving the insoluble parts to form an image or relief.

From these, moulds in wax or plaster are made, from which a copper relief block for typographic printing is made by the electrotype process. To obtain half tones by grain from an ordinary negative, Waterhouse's method is as follows:

A Woodbury relief is first developed on a silvered copper plate, washed, immersed in a solution of dichromate, drained, and dusted over with very fine waxed sand. When dry this is brushed off, and it will be found to have granulated or pitted the gelatine image, the pits being deepest in the thicker parts. From this an electrotype is made which forms the printing plate.

Photo-Zincography.—Processes similar to those described under photo-lithography, but the image, instead of being transferred or printed direct upon the stone, is transferred or printed upon a zinc plate, which is then treated with an acid to engrave the lights and give a slight relief to the remaining parts.

Photo-Engraving.—Although the term practically includes many of the processes already described and many others, yet it is now generally applied to what is also termed the half tone process, by means of which a metal relief block for typographic printing is made from a photograph, drawing, or direct from the object itself.

A collodion negative is first made. In front of the sensitized plate a glass screen is fitted, having on it a number of fine black lines ruled both ways. These lines are made by mechanically ruling the glass with a diamond and filling in the cuts with a black substance. They are ruled from eighty to two hundred lines to the inch, and form a fine network through which the image must pass before it reaches the plate. The result is that half tones are broken up into a series of dots ranging in size according to the amount of light passing through. A copper or zinc plate is polished and immersed in a weak solution of nitric acid to give a biting surface. It is afterward coated with albumen containing a dichromate and dried. Exposure under the negative is the next operation, after which the whole surface is inked all over with an even film of transfer ink. The plate is then immersed in a dish of clear cold water, and gently wiped with a piece of soft substance, which removes the albumen and ink from the unexposed parts. When dry again, the plate is dusted with finely powdered bitumen, and held over a stove until the powder just softens sufficiently to adhere. In this manner we have a bitumen image on the plate capable of resisting the acid, which is next applied to eat the copper from the bare portions. A process that is now being employed very largely by photo-engravers in this country is known as the enamel process. In this a mixture of fish glue, albumen and dichromate is used to coat the plate. After exposure and development it is heated over a stove until the color turns to a deep brown. When cool it is ready for etching.

Typogravure.—A process invented by Major De la Noe. A prepared plate is coated with a film of sensitive bitumen, exposed, and developed as usual. The plate is then etched with diluted nitric acid until the depth of about $\frac{1}{12}$ of an inch is reached. It is then dried and again coated with bitumen. The ground is next polished off with a stick of charcoal, leaving the bitumen on the lines, after which the plate is gummed and printed from as in photo-zincography.

Photo-gravure.—The idea of making copper intaglio plates by means of photography was first worked out by Niepce. Many other processes have followed.

About 1870 to 1871 Woodbury suggested to Goupil & Co. a method of photo-gravure, which was taken up by that firm and worked with considerable success. A gelatine relief was made in the same manner as for the Woodburytype process, except that a fine gritty powder was added to the gelatine to give the necessary grain. From this relief a mould and electrotype are made.

The process that is generally employed may be described as follows:

From the negative to be reproduced a positive transparency is produced. From this a carbon print is made, which will of course be a negative one. This is transferred and developed upon a copper plate (to which a fine grain has been given by dusting over with fine bitumen powder and heating), and forms the resist in the etching bath. After treating with the etching fluid (perchloride of iron) the carbon image is removed and the plate cleaned. It can then be printed from in the same manner as a copper-plate etching or mezzo-tint engraving.

Goupil-gravure is a method of making fac-similes of water-color drawings. The plate is carefully inked in by hand with the different colored printing inks, and the picture printed by one impression. The method is, of course, very costly, as skilled artists have to be employed for coloring the plates.

Three-color Printing.—This is a process still in its infancy, although very important results have been obtained during the last year or two. The aim of the process is to obtain by three printings a perfect fac-simile of a colored picture or object. Three negatives are made, the plates being color sensitized by means of three different dyes, each of which will absorb one-third of the spectrum, and reflect the other two-thirds. The effect is further assisted by the interposition of different color screens, which absorb certain rays, and allow others to pass through to the plate. From these negatives three printing plates are made by the collotype or half-tone engraving process. One is printed from with a yellow ink, the other with a red, and the third with a blue. The superimposition of these colors and their combinations should give in the final result a fac-simile of the original colored object. That is, theoretically they should do so, but the theory breaks down in practice, principally owing to the want of printing inks answering the necessary requirements of color and transparency. The subject has, however, already become a most fascinating study, and results have been obtained which are equal to pictures printed in a much larger number of colors.

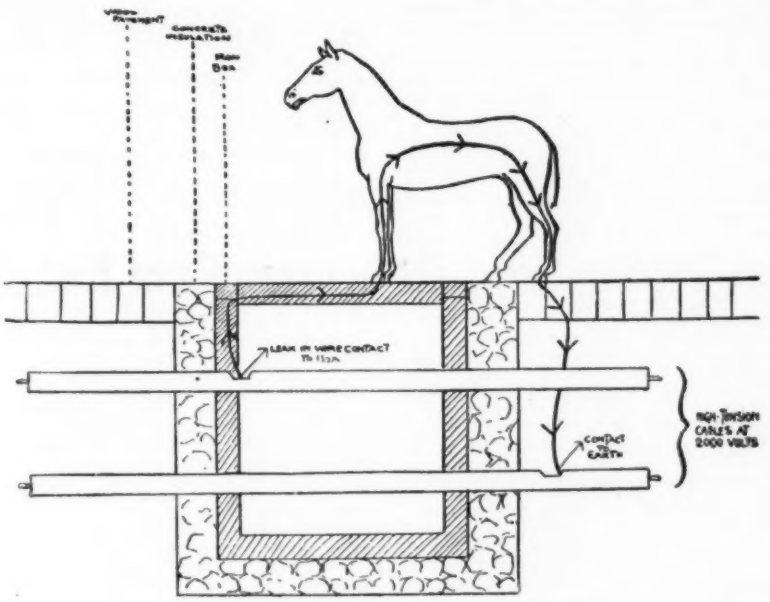
The above sketch of photo-mechanical printing methods, written at a few hours' notice, is necessarily very incomplete. To include the whole number would have required a book of several hundred pages; but if it enables the reader to better understand the various specimens exhibited upon the walls of this exhibition, its purpose is served. There are already a number of well written works upon the subject to which the student seeking further information is referred.

* In order to avoid distortion by expansion or contraction of the paper supporting the transfer, tinfoil is now used by many workers.

A HORSE KILLED BY ELECTRICITY.

REFERRING to the recent electric explosion in Cannon Street, London, Alderman Bell, chairman of the City Sewers Committee, at the meeting of the City Corporation, stated that the accident was caused by the confusion of two high pressure cables at Bankside, in consequence of which a current was unintentionally put on to a cable which was touching the ground, and which caused the cable to break down, the resulting sparks igniting the gas which leaked in the boxes. The shock which killed a horse would not harm a human being.

The diagram we publish serves to explain the cause of the accident. The cables used are high tension at 2,000 volts. There had been a slight leak of gas into the tube which carries the wire and, as explained by Alderman Bell, the electric current had at the same time been accidentally put on to a cable which was touching the ground. The horse, stepping on the iron box, which is used to examine and repair the wires, with its fore legs, made a circuit with the ground, through which the wire at once discharged its electricity. The result was fatal to the horse. Not only that, but when the horse completed the circuit "sparking" took place inside the box and set fire to the insulation composition on the wires. This in turn fired the gas which had accumulated in the "wire tube," and the result was the explosion, which knocked down two men.—The Daily Graphic, London.



A HORSE KILLED BY ELECTRICITY.

ICE FROM NATURAL GAS.

IT is probable that, before the natural gas supply of certain parts of the United States is exhausted, this gift of nature will be better utilized than has hitherto been the case. Indeed, it would not be surprising if the advantages of the natural gas supply were only to become fully appreciated just before it ceases forever. It appears from a recent contribution to an Indianapolis newspaper, that a local firm have constructed a refrigerator for making ice by means of the cold produced by the expansion of natural gas to atmospheric pressure. This is the principle of all artificial ice machines; yet it seems to have only just occurred to some American engineers that natural gas as it issues from the wells at pressures amounting in some instances to 20 atmospheres, and at a temperature of 42° Fah., presents the sole physical condition necessary for the production of cold by gaseous expansion. Assuming the density of the gas to be only half that of the surrounding air, 1,000 cubic feet of it will weigh 38·5 pounds.

According to Pictet's formula, by expanding a gas from a pressure of 20 atmospheres to that of 1 atmosphere, its temperature would be reduced 318° Fah. below freezing; and by expanding 1,000 cubic feet of gas per minute, there would be a cooling effect of 318° × 38·5 pounds, which would make 72 pounds of ice per minute from water at 62° Fah. Hence a very ordinary gas well, supplying 1½ million cubic feet per diem, is theoretically capable of producing 51 tons of ice daily at a cost of not more than 50 cents per ton; and, after all, if delivered in its expanded state to furnaces, etc., the gas would produce, on burning, as much heat as if it were delivered for fuel direct from the well. Hence, by proper management, the natural gas supply of Indiana and Ohio should supply all the ice wanted by these States during the hot season, as it actually furnishes most of the heat required all the year round.—Journal of Gas Lighting.

[FROM THE AMERICAN JOURNAL OF PHARMACY.]

ON SOME OF THE TESTS FOR QUININE.

By THEODORE G. WORMLEY, M.D.

THE recognition of quinine by chemical tests, when present in notable quantity, is usually a matter of great ease. Under certain conditions, however, as in its extraction from complex organic mixtures or from the tissues, it may be recovered only in minute quantity, and its presence may then not be so readily determined, at least by purely chemical tests. Among the strictly chemical tests for this substance, the thalleioquin reaction, as it is termed, is one of the most characteristic, and at the same time one of the most delicate. This test, however, requires caution in its application, since it may give a negative result even in the presence of quinine in considerable quantity.

1. THALLEIOQUIN TEST.

This test was first proposed by Professor M. Andre, of Mentz, in 1835, and consists in the production of a bright emerald green coloration when a solution of a salt of quinine is treated with chlorine water, followed by the addition of a little aqua ammonia. M. Andre observed that this order of the application of the reagents was necessary for the production of the green color.

R. Brands, in 1839, more fully examined this reaction and found that the production of the green color was dependent upon the presence of the substances employed in certain proportions, otherwise it did not appear. He found that the chlorine caused a decomposition of the quinine which varied with the amount of chlorine employed, and thus determined whether a green precipitate would be produced or the liquid simply acquire a green color or become yellow.

The green precipitate thus produced was found to have a bitter taste similar to that of quinine; was insoluble in cold water and only sparingly soluble in boiling water; insoluble in ether, but readily soluble in alcohol, and readily soluble in diluted acids forming red solutions, from which it was reprecipitated of a green color on neutralizing the solution with ammonia.

In 1853, A. Vogel proposed to modify this test by treating the quinine solution, after addition of chlorine water, with a solution of potassium ferrocyanide and then adding a few drops of ammonia, when the mixture would assume a deep red color, the green color not appearing.

Professor Fluckiger, in 1861, confirmed the observation of Vogel and found that the same red coloration might be produced by substituting potassium ferricyanide for the ferrocyanide.

More recently, Charles F. Zeller has examined this test in regard to the production of a green coloration under the action of chlorine and ammonia, and confirmed the observations of Brands, namely: that the results were influenced by the relative proportion of the substances employed.

It being thus shown that this test was much influenced by the relative proportions of quinine and chlorine present, the following investigations were made for the purpose of more definitely determining the range within which the green coloration would manifest itself in different quantities of the same solution, and in solutions of different degrees of dilution.

The quinine was employed in solution both as sulphate and hydrochloride, the 1-100th solutions being prepared by dissolving, by the aid of just sufficient of the diluted acid to effect solution, 1 gramme of the pure alkaloid in 100 c. c. of water. The more dilute solutions were prepared from the 1-100th solutions, by the required dilution with water.

The chlorine water consisted of a saturated aqueous solution of the washed gas. This solution, for uniformity of results, should be freshly prepared and preserved from the action of light. When this reagent was used in the form of drops, these were delivered from a pipette delivering on an average twenty-five drops per cubic centimeter. The ammonia employed had a density of 950.

A. 1-100th solution of quinine.

1. 5 c. c. of this solution (= 50 mgms. quinine) yields with:
   (a) 0·1 c. c. of chlorine water: a colorless solution which, on the addition of a drop of ammonia, yields a copious white precipitate (of quinine), and after a little time, the mixture acquires a rose-red color; on the addition of a second drop of ammonia, the mixture becomes colorless, then slowly assumes a greenish hue, which becomes well marked.
   (b) 0·5 c. c. of chlorine water, followed by a drop of ammonia, yields a copious white precipitate, and the mixture quickly assumes a green color, then becomes dark rose-red and finally green.
   (c) 1·0 c. c. chlorine water and a drop of ammonia: an immediate green color, which quickly changes to dark red, then to purple or blue.
2. 1 c. c. of a 1-100th solution (= 10 mgms. quinine) yields with:
   (a) One drop chlorine water and then a drop of ammonia: a copious white precipitate, which quickly assumes a green color.
   (b) 0·5 c. c. chlorine water and a drop of ammonia: an intense green coloration.
   (c) 1·0 c. c. chlorine water and one drop of ammonia: a bright green coloration, which becomes darker in color and finally nearly black.
3. 0·1 c. c. of a 1-100th solution (= 1 mgm. quinine) in a very small, narrow test tube, yields with:
   (a) One drop of chlorine water and a drop of ammonia: a copious green precipitate.
   (b) Two drops of chlorine water and a drop of ammonia: a bright green coloration
   (c) Three drops chlorine water and a drop of ammonia: no precipitate, but the mixture immediately acquires a bright green color, which quickly darkens.

B. 1-1000th solution of quinine.

1. 5 c. c. of the solution (= 5 mgms. quinine) yields with:
   (a) One drop chlorine water and a drop of ammonia: a white precipitate (quinine) which quickly assumes a greenish hue, slowly changing to well marked bluish green.
   (b) 0·1 c. c. chlorine water and one drop of ammonia: the precipitate quickly acquires a strong bluish green color.
   (c) 0·5 c. c. chlorine water and a drop of ammonia: an intense, emerald green coloration.
   (d) 1·0 c. c. chlorine water and one drop of ammonia: no precipitate, but a strong yellow coloration, which soon changes to deep purple.
   (e) 2·0 c. c. chlorine water and a drop of ammonia: a colorless mixture; on further addition of ammonia, a dirty brown coloration may be produced.
2. 1 c. c. of a 1-1000th quinine solution yields with one drop of ammonia, after addition of:
   (a) One drop of chlorine water: a green turbid mixture.
   (b) 0·1 c. c. chlorine water: a bright green coloration.
   (c) 0·5 c. c. of the chlorine reagent: a pale green coloration.
   (d) 1·0 c. c. chlorine water: a slightly yellow mixture.
3. 0·1 c. c. of a 1-1000th solution, under like conditions, yields with:
   (a) One drop chlorine water: a very bright green coloration.
   (b) Two drops of the chlorine reagent: a less intense green coloration.

C. 1-5000th solution of quinine.

1. 5 c. c. of the solution = (1 mg. quinine) yields with a drop of ammonia, after the addition of:
   (a) One drop chlorine water: a colorless solution, which, after a time, may acquire a greenish hue.
   (b) 0·2 c. c. chlorine water: a fine, emerald green solution.
   (c) 0·5 c. c. chlorine water: a well marked green coloration, quickly discharged on shaking the mixture.
   (d) 1·0 c. c. of chlorine reagent: no coloration, but, after a time, the mixture assumes a yellow hue.
2. 1 c. c. of a 1-5000th solution, with one drop of ammonia after adding:
   (a) One drop chlorine water: a fine, green coloration, changing to bluish green.
   (b) 0·1 c. c. chlorine water: a pale green coloration.
   (c) 0·5 c. c. chlorine reagent: a light green color, quickly changing to a faintly yellow.
3. 0·1 c. c. of 1-5000th solution, with one drop ammonia, after adding:
   (a) One drop chlorine water: a well-marked green coloration.
   (b) Two drops chlorine water: only a faintly yellowish color.

D. 1-10000th solution of quinine.

1. 5 c. c. of the solution (= 0·5 mg. quinine) yields with one drop of ammonia, after addition of:
   (a) One drop chlorine water: the mixture slowly acquires a greenish hue.
   (b) Two drops chlorine water: a strongly marked green coloration.
   (c) 0·2 c. c. of chlorine water: a colorless mixture.
2. 1 c. c. of a 1-10000th solution yields with:
   (a) One drop chlorine water and one drop ammonia: a marked green coloration.
   (b) Two drops chlorine water and a drop of ammonia: the mixture may present a greenish hue, which quickly changes to yellow.

From 0·1 c. c. of a 1-10000th quinine solution, a greenish coloration may be obtained by employing a drop of a much diluted solution of chlorine.

From 5 c. c. of a 1-20000th solution of quinine, no green coloration was obtained, even on employing a diluted solution of chlorine.

In 1872, Professor Fluckiger* proposed to substitute bromine for chlorine in this test, and stated that its reaction was much more delicate than that of chlorine, since under it a green coloration might be obtained from a 1-20000th solution of quinine, whereas, chlorine had its limit in about a 1-5000th solution.

In the following examinations a saturated aqueous solution of bromine was employed, it being prepared by agitating excess of bromine with water, and, after subsidence, decanting the clear, highly colored solution. The reagent should be freshly prepared, since it may, within twenty-four hours, especially if exposed to light, undergo a marked change. A saturated aqueous solution of the reagent contains practically 1 per cent. by volume, or 3 per cent. by weight of bromine.

A. 1-100th solution of quinine.

1. 5 c. c. of the solution yields with:
   (a) One drop of bromine water: a copious yellow precipitate which quickly dissolves to a colorless solution, the addition of a drop of ammonia causes a white precipitate (quinine), which, after a time, acquires a bluish hue, then a bluish green color.
   (b) Three drops bromine water, then one drop ammonia, yield a precipitate which soon assumes a greenish blue color.
   (c) 0·5 c. c. bromine water followed by one drop ammonia: the mixture quickly becomes bluish green, which increases its intensity.
   (d) 1·0 c. c. bromine water causes a slightly yellow coloration; the addition of 0·1 c. c. ammonia produces a white precipitate which quickly assumes a bright green color, which may change to purple.

The exact coloration produced in the above solutions depends somewhat upon the manner in which the reagents mix with the quinine solution. The best results are obtained by dropping the reagents into the quinine solution without agitation.

2. 1 c. c. of the quinine solution yields with one drop of ammonia after addition of:
   (a) One drop bromine water: a white precipitate which soon assumes a green color.
   (b) 0·2 c. c. bromine water: quickly a bright green solution.
   (c) 0·5 c. c. bromine water: a purple precipitate, which, after a time, assumes a strong green color.
3. 0·1 c. c. of a 1-100th quinine solution yields with one drop of bromine water and a drop of ammonia, a white precipitate, which quickly assumes a green color.

* Neues Jahr. f. Pharm., 1872. 139.

B. 1-1000th solution of quinine.

1. 5 c. c. of the solution yields with one drop of ammonia, after adding:
   (a) One drop bromine water: a white precipitate which soon assumes a bluish-green color.
   (b) 0·1 c. c. bromine: an immediate bright green coloration.
   (c) 0·3 c. c. bromine water alone causes a yellow coloration, which, on addition of the ammonia, is changed to deep purple, and this may slowly change to very dark green.
2. 1 c. c. of the quinine solution with one drop of the bromine water and one drop of ammonia will yield a bright green coloration. Under the action of a slightly larger quantity of the bromine reagent, only a purple color will appear, or the mixture will remain colorless.
3. 0·1 c. c. of the quinine solution with a minute drop of the bromine water and one drop of ammonia, will yield a green coloration; but if a full drop of the bromine reagent be employed, a colorless mixture will result. With a diluted solution of the bromine water (1:4), a fine green coloration may be obtained.

C. 1-5000th solution of quinine.

1. 5 c. c. of the solution with one or two drops of the bromine water and one drop ammonia yields a good green coloration. With a slightly larger amount of the bromine reagent, the mixture remains colorless.
2. 1 c. c. of the quinine solution with one drop of bromine water and one drop ammonia will after a time acquire a green coloration. If two drops of the bromine water be employed, the mixture remains permanently colorless.
3. 0·1 c. c. yields with a drop of the bromine reagent a deep yellow color, which is quickly discharged to a permanently colorless solution by a drop of ammonia. Under the action of a drop of diluted bromine water (1:9), a bright green coloration may be obtained.

D. 1-10000th solution of quinine.

1. 5 c. c. of the solution with:
   (a) One drop bromine water yields a colorless solution, which on addition of a drop of ammonia quickly assumes a green color; this becomes deep bright green, which remains unchanged for many hours.
   (b) Two drops of bromine water causes a yellow color, which is immediately discharged by a drop of ammonia, and the mixture remains colorless.
2. 1 c. c. of the quinine solution fails to yield a green coloration unless the bromine reagent be diluted.
3. From 0·1 c. c. of the quinine solution, no green coloration was obtained, even with the diluted bromine reagent.

E. 1-20000th quinine solution.

5 c. c. of this solution yields no green coloration with the undiluted bromine reagent; but under a dilution of 1:2 a well-marked green color may be obtained.

From the foregoing it is obvious that the production of a green color under the action of this test depends upon the presence of the quinine and bromine in proportion contained within rather narrow limits; otherwise the green coloration will not manifest itself. Should it be desired to apply this test to only a small and limited quantity of a suspected solution, it would be necessary, or at least advisable, to first ascertain under what conditions a similar volume of solution of quinine of known strength would give a positive reaction with a given quantity of the bromine reagent, after proper dilution of the latter if necessary.

If an aqueous solution of chlorine, instead of bromine, be employed in the thalleioquin test, a positive reaction will manifest itself through a greater range than when bromine is employed, the result being less readily affected by excess or deficiency of the reagent.

In regard to the production of a red coloration, by treating the quinine solution, after addition of bromine or chlorine, and before adding the ammonia, with potassium ferrocyanide solution, as advised by Vogel, the results were less satisfactory than the test without the use of the potassium salt. With solutions containing more than 1-1000th of the alkaloid, a green or red or other coloration may be developed, the result depending upon the relative proportions of the reagents employed.

On treating 5 c. c. of a 1-1000th quinine solution with one drop of bromine water followed by one drop of potassium ferrocyanide solution (1:12) and a drop of ammonia, the result is about the same as without the presence of the potassium salt; that is, a white precipitate soon becoming green is produced. But, if under these conditions 0·2 c. c. of the potassium solution be employed, a portion of the mixture may be red and a portion green in color.

5 c. c. of a 1-5000th solution of the alkaloid under the action of one drop each of the reagents as above yields a fine green coloration. If, however, to this quantity of the quinine solution one drop of bromine water be added and then 0·5 c. c. of the ferrocyanide solution, the mixture, without the addition of ammonia, immediately assumes a deep red color. If a drop of ammonia be now added, the red color quickly changes to a beautiful purple.

5 c. c. of a 1-10000th quinine solution with one drop each of the reagents yields a fine red purple coloration which soon changes to green.

5 c. c. of a 1-20000th solution, under like conditions, yields a fine red coloration, which quickly fades to a light yellow color.

2. HERAPATHITE TEST.

This test was first proposed by Dr. Herapath, in 1852, and consists in the formation of quinine iodosulphate or herapathite, as it has been termed. This compound may be obtained by treating a solution of quinine in a mixture of strong acetic acid and alcohol, with an alcoholic solution of iodine. In a little time the iodosulphate separates out in the form of characteristic plates and rosette groups of crystals. By reflected light, the crystals are of a dark green color; under transmitted light they are dichroic and strongly polarize light.

The reagents may be prepared as follows: (a) Thirty volumes of strong acetic acid are mixed with ten volumes of strong alcohol and one volume of diluted

sulphuric acid (1:10). (b) One part of iodine dissolved in about twenty parts weight of alcohol.

To apply the test, a drop of the quinine solution is evaporated to dryness, and the residue treated with a drop of the first mentioned solution; a minute drop, or sufficient to color the liquid brownish-yellow, of the alcoholic solution of iodine is then added. Very soon portions of the mixture will present a dark green deposit, which when examined by a moderate power (75 diam.) of the microscope will be found to consist of the crystals in question. The formation of these crystals is perfectly characteristic of quinine.

The residue from one drop of a 1-100th solution of quinine, in the form of sulphate, when treated with a drop of the acetic acid mixture and then sufficient of the iodine solution to impart a strong color, will yield innumerable crystals of the iodosulphate compound.

A 1-500th solution residue will generally yield an abundant deposit of the crystals.

The residue from a drop of a 1-1000th solution, if simply moistened with the acetic acid liquid and then with a minute drop of the iodine solution, may yield satisfactory results; but it requires a nice adjustment of the reagents to obtain satisfactory results from this quantity of the alkaloid.

3. FLUORESCENCE.

One of the most striking properties, and at the same time the most delicate reaction of quinine at present known, is the fluorescence of solutions of its oxysalts, especially the sulphate. Normal solutions of the hydrochloride, hydrobromide, hydriodide and hydrocyanide present little or no fluorescence. A solution of the hydrochloride containing a limited excess of hydrochloric acid may, as pointed out by Prof. R. A. Witthaus,* present a well marked or even strong fluorescence, especially in dilute solutions; but this is permanently destroyed by a slightly larger quantity of the free acid.

When in solution as quinine normal acid sulphate, without excess of acid, and examined by ordinary reflected light in volumes of 50 to 100 c. c. the blue fluorescence is very intense in the 1-100th, 1-1000th, and 1-10000th solutions, and very well marked in a 1-50000th solution; but it is not apparent in a 1-100000th solution; and is only faintly marked even under a cone of condensed sunlight.

If 1 c. c. of the acid sulphate solution, placed in a small test tube, be examined, it will present as follows:

1. 1-100th solution, a very strong blue fluorescence in reflected light, which becomes intense in condensed sunlight

2. 1-1000th solution, a strongly marked fluorescence in reflected light; only feebly marked in direct sunlight; but intense in a cone of sunlight.

3. 1-10000th solution, a just perceptible fluorescence in reflected light; appears colorless in sunlight; intensely fluorescent in a cone of sunlight.

4. 1-50000th solution exhibits no marked fluorescence in either reflected or in direct sunlight, and only a faint fluorescence under a cone of sunlight. On the addition of a drop of dilute sulphuric acid, the solution presents a quite well marked fluorescence in condensed sunlight.

5. 1-100000th solution in condensed sunlight presents only a faint fluorescence; but on addition of a drop dilute sulphuric acid, the fluorescence is well marked.

The last mentioned degree of dilution is by no means the limit of the fluorescence of quinine solutions, under certain conditions. Kerner, by a specially constructed instrument, termed by him the fluorescope, was able to obtain the fluorescence beautifully marked in a solution of the alkaloid under a dilution of two million times.

It should be borne in mind that the fluorescence of quinine solutions, even of the sulphate, may be entirely prevented by the presence of chlorides, bromides and iodides, and the free acids of these salts. If to 1 c. c. of a 1-100th solution of quinine sulphate, which is strongly fluorescent, one drop of hydrochloric acid or of a solution of sodium chloride (1:10), be added, the fluorescence is immediately and wholly destroyed, and is not reproduced on the addition of even 0·5 c. c. of dilute sulphuric acid. The interference of bromine and iodine is as prompt and complete as that of chlorine.

According to the recent observations of MM. Sestini and Campani† the fluorescence of sulphuric acid solutions of quinine, especially when dilute, may also be concealed by the presence of phenacetine. According to these observers, this substance may also greatly interfere with the normal reaction of quinine with both chlorine and bromine in the thalleioquin test.

The property of fluorescence is possessed, although in a less degree, by some of the other cinchona alkaloids; and Dr. Bence Jones, of London, has described a substance normally present in the body, which has a similar property, and named by him animal quinoidine. Besides these substances, certain vegetable principles and extracts and the hydrocarbon oils present fluorescent properties.

4. TEST OF TASTE.

The intensely bitter taste of quinine and its salts may serve as a test of its presence. Of the ordinary preparations of quinine, the tannate is the least and the free alkaloid next least bitter; the normal sulphate is less bitter than the bisulphate, hydrobromide or hydrochloride.‡

The taste of the acid sulphate is very distinct and strongly marked in a single drop of a 1-10000th solution; and is still distinct in the same quantity of a 1-20000th solution; but according to several persons is not perceived in a drop of a 1-50000th solution.

In the very elaborate investigations of Dr. G. Kerner§ on the absorption and elimination of quinine, he found that when taken into the stomach in 0·5 gramme (7·5 grains) doses, it appeared in the urine fifteen minutes thereafter; and that one-half of the total quantity taken was thus eliminated in six hours, and one-fourth in the following six hours, but that a trace might still be present in the urine at the end of seventy-eight hours.

* Researches Loomis Laboratory, 1892, 91.
† Jour. Chem. Soc., Abs., May, 1892, 665.
‡ Prescott's Organic Analysis, p. 127.
§ Archiv fur Physiologie, ii., 1869, pp. 200-243; iii., 1870, 93-165.

Of the quinine thus eliminated, Dr. Kerner found that a large portion had undergone a material change, in that while it still possessed fluorescent properties, responded to the reaction with chlorine and ammonia, and with chlorine and potassium ferrocyanide, it no longer had a bitter taste, it now being tasteless. By experiments he found that under the limited oxidation of quinine by potassium permanganate, a substance was produced which was tasteless and corresponded in every respect to this eliminated quinine. On analysis this oxidation product was found to be dihydroxyl quinine, having the composition $C_{20}H_{24}N_2O_2$, $2OH$. From these results Dr. Kerner concluded that it was under this form that the alkaloid, in part at least, appeared in its tasteless condition in the urine.

If, then, in the absorption of quinine or under oxidation, this change to the tasteless variety may take place, it is easy to understand that in the extraction of the alkaloid from the urine or the tissues, this important corroborative test might fail, even when the chemical tests indicated its presence. At present we have little or no experience in regard to the recovery of quinine from the body long periods after death.

That the alkaloids in general may undergo a slow and gradual change in the presence of decomposing animal matter seems to be fully established by the investigations of Profs. Buchner, Gorup-Besanez and others,* as well as our own observations, in the case of strychnine, which, under the conditions stated, after a time loses its property of responding to the color and certain other chemical tests, but still retains its bitter taste and the property of producing tetanic convulsions in frogs.

So also Dr. Pellacani,† on mixing a definite quantity of curarine with a given quantity of fresh blood and allowing the mixture to purify under favorable conditions of temperature, found after some months that the alkaloid no longer responded to the physiological test, although it still retained its chemical properties, except with the sulphuric acid test.

From our own experience, we are strongly led to believe that when morphine and strychnine are taken in moderate toxic quantity, that portion of the alkaloid which is carried to the tissues by the ordinary process of absorption entirely loses its property of crystallizing, even when present in quantity sufficient to promptly respond to chemical tests.

When the morphine or strychnine is taken in excessive quantity, a portion seems to be distributed to the organs by simple exosmotic diffusion, and this may readily be recovered in the crystalline state. In a case in which 1·68 grammes (about 26 grains) of strychnine were administered subcutaneously to a dog during a period of four hours, in divided doses, so as to keep the animal paralyzed, 56 mgs. of well-crystallized strychnine was recovered from the urine, 26 mgs. from the liver and 14 mgs. from the blood.

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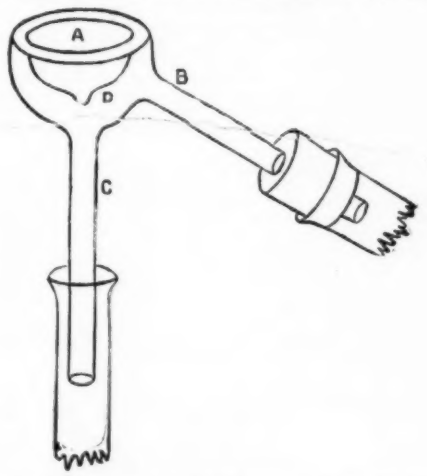
* Ann. d'Hyg., 1881, 385.
† Rivista Sper Med. Legal, xiii., 2, p. 237.

A TEST-TUBE CONDENSER.

By C. J. BROOKS.

THE accompanying sketch of a small condenser for use with test-tubes will be found useful for separating



volatile substances on a small scale. The glass bulb, A, has a reservoir, D, in which the cooling medium is placed, on the cold inner surface of which the vapor will condense as it is driven from the test-tube through B. The condensed liquid then falls through tube, C, and is collected in another test-tube.—Chemical News.

NITROGEN TRIOXIDE.

ACCORDING to Nature, an important memoir concerning nitrogen trioxide, nitrous anhydride, N_2O_3, is communicated by Prof. Lunge and Herr Porschnew to the current issue of the Zeitschrift fur Anorganische Chemie. It is claimed that the investigation, whose results are now published, finally disposes of all doubt as to the existence of this much-discussed oxide of nitrogen. The main conclusion derived from the work is that nitrogen trioxide is a well characterized individual substance, which is readily formed under ordinary atmospheric pressure below the temperature of —21° by the union of nitric oxide NO and nitrogen peroxide N_2O_4, and constitutes an indigo blue liquid. It is stated to be perfectly stable at and below this temperature; but at a temperature slightly superior to this, even under pressure, it commences to decompose, and the dissociation is almost complete upon the conversion of the liquid into gas. Nitrous anhydride in a condition of purity thus appears to be incapable of existence in the gaseous state, while forming a comparatively stable liquid at temperatures below —21°. The gaseous product of dissociation, a mixture of nitric oxide and peroxide, exhibits similar chemical properties to those which might have been expected of gaseous nitrogen trioxide, hence of course the difficulty which has been experienced in deciding the question. It is pointed out, however, that the absolute incapability of existence of gaseous molecules of nitrogen trioxide is not proved, and the results of the investigation would appear to indicate that a residue of such molecules does escape dissociation upon the passage of the liquid into the gaseous state, and exists side by side with the molecules of the decomposition products. The experiments upon which these conclusions are based are mainly the following. It was first established that nitric oxide and nitrogen peroxide exhibit only the very slightest inclination to unite chemically at the ordinary temperature and at temperatures up to 100°. It was next found that at the temperature of —21° the two oxides combined in practically exactly molecular proportions to form the indigo blue liquid. The exact amount of N_2O_3 present in one of the specimens analyzed is stated to have been 98·3 per cent. The well known work of Ramsay and Cundall upon the subject is, of course, quoted, and it is stated that the apparently small amount of absorption of nitric oxide by liquid nitrogen peroxide, corresponding to only 3·5 per cent. of N_2O_3, observed during that investigation, was due to the loss of weight by mechanical removal of a portion of the nitrogen peroxide in the stream of issuing nitric oxide. It was further demonstrated that the product of the action of oxygen upon nitric oxide gas behaves, particularly toward sulphuric acid, precisely like a mixture, which it probably is, of nitric oxide and nitrogen peroxide. Moreover, the vapor derived from liquid nitrogen trioxide is not stable toward oxygen, but becomes further oxidized until it is almost pure peroxide. The memoir will be found to include an admirable summary of the literature of the subject, together with the views of Prof. Lunge concerning the bearing of the main conclusions of the investigation upon the theory of the sulphuric acid manufacture.

INFLUENCE OF BOILING ON GLASS VESSELS.

THAT a boiling fluid dissolves alkali in glass is shown by the following experiment:

To 300 c. c. of distilled water, placed in an ordinary boiling flask, lime water was added, and after boiling and cooling titrated with decinormal HCl. On boiling for fifteen minutes 0·03 c. c. additional acid was required, and the same quantity on again boiling for fifteen minutes.

With larger quantities of liquid the error caused by boiling for fifteen minutes was so increased that the advantage of using a decinormal acid was quite lost. 700 c. c. of distilled water boiled for four hours in a new Erlenmeyer flask required 9·53 c. c. of $\frac{1}{10}$ N acid to neutralize the dissolved alkali. After continuing the boiling for fifteen minutes the reading was 10·22 c. c., rising to 10·92 c. c. when again boiled for the same length of time.

A Bohemian hard-melting potash glass offered about ten times the resistance of ordinary glass. After four hours' boiling 700 c. c. required 1·09 c. c. $\frac{1}{10}$ N acid to neutralize the dissolved alkali, rising after ten minutes longer boiling to 1·14 c. c., and to 1·16 c. c. after a subsequent seven minutes. Thus the amount of alkali dissolved by boiling liquids for not more than ten minutes in vessels of this kind of glass affects the accuracy of the result but slightly.

It was not, however, until he used vessels made of Dr. Schott's new Jena glass that the author was able to obtain perfectly satisfactory results in standardizing solutions. In a flask of this glass 700 c. c. of distilled water boiled for four hours used 0·13 c. c. $\frac{1}{10}$ N acid, which after eighteen minutes' further boiling became 0·18 c. c.—The Analyst.

PROTEID POISONS.*

PROTEID poisons have been obtained from both the vegetable and animal kingdoms. Thus among those obtained from plants, one may mention the proteids obtained from jequirity seeds, the proteid associated with or identical with the ferment papain of the papaw plant, and lupino-toxin from the yellow lupin.

The most important of the animal proteid poisons are snake poisons; the proteids in the serum of the conger eel and other fish; and proteid poisons found in certain spiders. Poisonous proteids are also formed during ordinary digestive processes in the alimentary canal of every one of us from the proteids taken in as food. The peptones and the proteoses or albumoses (intermediate products in the process of hydration of which the terminal product is peptone) are fairly powerful poisons. 0·3 gramme per kilogramme of body weight injected into the blood will kill a dog, producing a loss of coagulability of the blood, a fall of blood pressure, a stoppage of secretions, and ultimately death by cessation of respiratory activity. Normally, animals are protected from this poison by the lining membrane of the alimentary canal, so that no proteose or peptone is found in blood or lymph even during the most active periods of digestion. The cells of this membrane possess many remarkable properties, but one of the most important is this power of regenerating albumen from peptone.

Allied to the albumoses of ordinary gastric activity are the similar products produced by bacteria. The way in which bacteria produce disease has long been a matter of dispute, but the problem appears to be approaching solution. Pathologists have at last turned their attention to the chemical side of the question, and shown that whereas in some cases the poisons produced by the growth of micro-organisms are alkaloidal in nature, in by far the greater number the toxic product is a proteid. The one which is best known, or at least attracted most attention, is the toxalbumose contained in Koch's tuberculin.

The foregoing list is far from complete, but one cannot conclude it without mentioning another class of proteid poisons: these are the nucleo-albumens obtainable by suitable methods from most of the cellular organs of the body. Originally discovered by Wooldridge, they were named by him tissue-fibrinogens, because they possess the remarkable power of

* Extracted from an article on "Snake Poison," by Professor W. D. Halliburton, F.R.S., in Science Progress.

[FROM THE AMERICAN JOURNAL OF PHARMACY.]

ON SOME OF THE TESTS FOR QUININE.

By THEODORE G. WORMLEY, M.D.

THE recognition of quinine by chemical tests, when present in notable quantity, is usually a matter of great ease. Under certain conditions, however, as in its extraction from complex organic mixtures or from the tissues, it may be recovered only in minute quantity, and its presence may then not be so readily determined, at least by purely chemical tests. Among the strictly chemical tests for this substance, the thalleioquin reaction, as it is termed, is one of the most characteristic, and at the same time one of the most delicate. This test, however, requires caution in its application, since it may give a negative result even in the presence of quinine in considerable quantity.

1. THALLEIOQUIN TEST.

This test was first proposed by Professor M. Andre, of Mentz, in 1835, and consists in the production of a bright emerald green coloration when a solution of a salt of quinine is treated with chlorine water, followed by the addition of a little aqua ammonia. M. Andre observed that this order of the application of the reagents was necessary for the production of the green color.

R. Brands, in 1839, more fully examined this reaction and found that the production of the green color was dependent upon the presence of the substances employed in certain proportions, otherwise it did not appear. He found that the chlorine caused a decomposition of the quinine which varied with the amount of chlorine employed, and thus determined whether a green precipitate would be produced or the liquid simply acquire a green color or become yellow.

The green precipitate thus produced was found to have a bitter taste similar to that of quinine; was insoluble in cold water and only sparingly soluble in boiling water; insoluble in ether, but readily soluble in alcohol, and readily soluble in diluted acids forming red solutions, from which it was reprecipitated of a green color on neutralizing the solution with ammonia.

In 1853, A. Vogel proposed to modify this test by treating the quinine solution, after addition of chlorine water, with a solution of potassium ferrocyanide and then adding a few drops of ammonia, when the mixture would assume a deep red color, the green color not appearing.

Professor Fluckiger, in 1861, confirmed the observation of Vogel and found that the same red coloration might be produced by substituting potassium ferricyanide for the ferrocyanide.

More recently, Charles F. Zeller has examined this test in regard to the production of a green coloration under the action of chlorine and ammonia, and confirmed the observations of Brands, namely: that the results were influenced by the relative proportion of the substances employed.

It being thus shown that this test was much influenced by the relative proportions of quinine and chlorine present, the following investigations were made for the purpose of more definitely determining the range within which the green coloration would manifest itself in different quantities of the same solution, and in solutions of different degrees of dilution.

The quinine was employed in solution both as sulphate and hydrochloride, the 1-100th solutions being prepared by dissolving, by the aid of just sufficient of the diluted acid to effect solution, 1 gramme of the pure alkaloid in 100 c. c. of water. The more dilute solutions were prepared from the 1-100th solutions, by the required dilution with water.

The chlorine water consisted of a saturated aqueous solution of the washed gas. This solution, for uniformity of results, should be freshly prepared and preserved from the action of light. When this reagent was used in the form of drops, these were delivered from a pipette delivering on an average twenty-five drops per cubic centimeter. The ammonia employed had a density of 950.

A. 1-100th solution of quinine.

1. 5 c. c. of this solution (= 50 mgms. quinine) yields with:
   (a) 0·1 c. c. of chlorine water: a colorless solution which, on the addition of a drop of ammonia, yields a copious white precipitate (of quinine), and after a little time, the mixture acquires a rose-red color; on the addition of a second drop of ammonia, the mixture becomes colorless, then slowly assumes a greenish hue, which becomes well marked.
   (b) 0·5 c. c. of chlorine water, followed by a drop of ammonia, yields a copious white precipitate, and the mixture quickly assumes a green color, then becomes dark rose-red and finally green.
   (c) 1·0 c. c. chlorine water and a drop of ammonia: an immediate green color, which quickly changes to dark red, then to purple or blue.
2. 1 c. c. of a 1-100th solution (= 10 mgms. quinine) yields with:
   (a) One drop chlorine water and then a drop of ammonia: a copious white precipitate, which quickly assumes a green color.
   (b) 0·5 c. c. chlorine water and a drop of ammonia: an intense green coloration.
   (c) 1·0 c. c. chlorine water and one drop of ammonia: a bright green coloration, which becomes darker in color and finally nearly black.
3. 0·1 c. c. of a 1-100th solution (= 1 mgm. quinine) in a very small, narrow test tube, yields with:
   (a) One drop of chlorine water and a drop of ammonia: a copious green precipitate.
   (b) Two drops of chlorine water and a drop of ammonia: a bright green coloration
   (c) Three drops chlorine water and a drop of ammonia: no precipitate, but the mixture immediately acquires a bright green color, which quickly darkens.

B. 1-1000th solution of quinine.

1. 5 c. c. of the solution (= 5 mgms. quinine) yields with:
   (a) One drop chlorine water and a drop of ammonia: a white precipitate (quinine) which quickly assumes a greenish hue, slowly changing to well marked bluish green.
   (b) 0·1 c. c. chlorine water and one drop of ammonia: the precipitate quickly acquires a strong bluish green color.
   (c) 0·5 c. c. chlorine water and a drop of ammonia: an intense, emerald green coloration.
   (d) 1·0 c. c. chlorine water and one drop of ammonia: no precipitate, but a strong yellow coloration, which soon changes to deep purple.
   (e) 2·0 c. c. chlorine water and a drop of ammonia: a colorless mixture; on further addition of ammonia, a dirty brown coloration may be produced.
2. 1 c. c. of a 1-1000th quinine solution yields with one drop of ammonia, after addition of:
   (a) One drop of chlorine water: a green turbid mixture.
   (b) 0·1 c. c. chlorine water: a bright green coloration.
   (c) 0·5 c. c. of the chlorine reagent: a pale green coloration.
   (d) 1·0 c. c. chlorine water: a slightly yellow mixture.
3. 0·1 c. c. of a 1-1000th solution, under like conditions, yields with:
   (a) One drop chlorine water: a very bright green coloration.
   (b) Two drops of the chlorine reagent: a less intense green coloration.

C. 1-5000th solution of quinine.

1. 5 c. c. of the solution = (1 mg. quinine) yields with a drop of ammonia, after the addition of:
   (a) One drop chlorine water: a colorless solution, which, after a time, may acquire a greenish hue.
   (b) 0·2 c. c. chlorine water: a fine, emerald green solution.
   (c) 0·5 c. c. chlorine water: a well marked green coloration, quickly discharged on shaking the mixture.
   (d) 1·0 c. c. of chlorine reagent: no coloration, but, after a time, the mixture assumes a yellow hue.
2. 1 c. c. of a 1-5000th solution, with one drop of ammonia after adding:
   (a) One drop chlorine water: a fine, green coloration, changing to bluish green.
   (b) 0·1 c. c. chlorine water: a pale green coloration.
   (c) 0·5 c. c. chlorine reagent: a light green color, quickly changing to a faintly yellow.
3. 0·1 c. c. of 1-5000th solution, with one drop ammonia, after adding:
   (a) One drop chlorine water: a well-marked green coloration.
   (b) Two drops chlorine water: only a faintly yellowish color.

D. 1-10000th solution of quinine.

1. 5 c. c. of the solution (= 0·5 mg. quinine) yields with one drop of ammonia, after addition of:
   (a) One drop chlorine water: the mixture slowly acquires a greenish hue.
   (b) Two drops chlorine water: a strongly marked green coloration.
   (c) 0·2 c. c. of chlorine water: a colorless mixture.
2. 1 c. c. of a 1-10000th solution yields with:
   (a) One drop chlorine water and one drop ammonia: a marked green coloration.
   (b) Two drops chlorine water and a drop of ammonia: the mixture may present a greenish hue, which quickly changes to yellow.

From 0·1 c. c. of a 1-10000th quinine solution, a greenish coloration may be obtained by employing a drop of a much diluted solution of chlorine.

From 5 c. c. of a 1-20000th solution of quinine, no green coloration was obtained, even on employing a diluted solution of chlorine.

In 1872, Professor Fluckiger* proposed to substitute bromine for chlorine in this test, and stated that its reaction was much more delicate than that of chlorine, since under it a green coloration might be obtained from a 1-20000th solution of quinine, whereas, chlorine had its limit in about a 1-5000th solution.

In the following examinations a saturated aqueous solution of bromine was employed, it being prepared by agitating excess of bromine with water, and, after subsidence, decanting the clear, highly colored solution. The reagent should be freshly prepared, since it may, within twenty-four hours, especially if exposed to light, undergo a marked change. A saturated aqueous solution of the reagent contains practically 1 per cent. by volume, or 3 per cent. by weight of bromine.

A. 1-100th solution of quinine.

1. 5 c. c. of the solution yields with:
   (a) One drop of bromine water: a copious yellow precipitate which quickly dissolves to a colorless solution, the addition of a drop of ammonia causes a white precipitate (quinine), which, after a time, acquires a bluish hue, then a bluish green color.
   (b) Three drops bromine water, then one drop ammonia, yield a precipitate which soon assumes a greenish blue color.
   (c) 0·5 c. c. bromine water followed by one drop ammonia: the mixture quickly becomes bluish green, which increases its intensity.
   (d) 1·0 c. c. bromine water causes a slightly yellow coloration; the addition of 0·1 c. c. ammonia produces a white precipitate which quickly assumes a bright green color, which may change to purple.

The exact coloration produced in the above solutions depends somewhat upon the manner in which the reagents mix with the quinine solution. The best results are obtained by dropping the reagents into the quinine solution without agitation.

2. 1 c. c. of the quinine solution yields with one drop of ammonia after addition of:
   (a) One drop bromine water: a white precipitate which soon assumes a green color.
   (b) 0·2 c. c. bromine water: quickly a bright green solution.
   (c) 0·5 c. c. bromine water: a purple precipitate, which, after a time, assumes a strong green color.
3. 0·1 c. c. of a 1-100th quinine solution yields with one drop of bromine water and a drop of ammonia, a white precipitate, which quickly assumes a green color.

B. 1-1000th solution of quinine.

1. 5 c. c. of the solution yields with one drop of ammonia, after adding:
   (a) One drop bromine water: a white precipitate which soon assumes a bluish-green color.
   (b) 0·1 c. c. bromine: an immediate bright green coloration.
   (c) 0·3 c. c. bromine water alone causes a yellow coloration, which, on addition of the ammonia, is changed to deep purple, and this may slowly change to very dark green.
2. 1 c. c. of the quinine solution with one drop of the bromine water and one drop of ammonia will yield a bright green coloration. Under the action of a slightly larger quantity of the bromine reagent, only a purple color will appear, or the mixture will remain colorless.
3. 0·1 c. c. of the quinine solution with a minute drop of the bromine water and one drop of ammonia, will yield a green coloration; but if a full drop of the bromine reagent be employed, a colorless mixture will result. With a diluted solution of the bromine water (1:4), a fine green coloration may be obtained.

C. 1-5000th solution of quinine.

1. 5 c. c. of the solution with one or two drops of the bromine water and one drop ammonia yields a good green coloration. With a slightly larger amount of the bromine reagent, the mixture remains colorless.
2. 1 c. c. of the quinine solution with one drop of bromine water and one drop ammonia will after a time acquire a green coloration. If two drops of the bromine water be employed, the mixture remains permanently colorless.
3. 0·1 c. c. yields with a drop of the bromine reagent a deep yellow color, which is quickly discharged to a permanently colorless solution by a drop of ammonia. Under the action of a drop of diluted bromine water (1:9), a bright green coloration may be obtained.

D. 1-10000th solution of quinine.

1. 5 c. c. of the solution with:
   (a) One drop bromine water yields a colorless solution, which on addition of a drop of ammonia quickly assumes a green color; this becomes deep bright green, which remains unchanged for many hours.
   (b) Two drops of bromine water causes a yellow color, which is immediately discharged by a drop of ammonia, and the mixture remains colorless.
2. 1 c. c. of the quinine solution fails to yield a green coloration unless the bromine reagent be diluted.
3. From 0·1 c. c. of the quinine solution, no green coloration was obtained, even with the diluted bromine reagent.

E. 1-20000th quinine solution.

5 c. c. of this solution yields no green coloration with the undiluted bromine reagent; but under a dilution of 1:2 a well-marked green color may be obtained.

From the foregoing it is obvious that the production of a green color under the action of this test depends upon the presence of the quinine and bromine in proportion contained within rather narrow limits; otherwise the green coloration will not manifest itself. Should it be desired to apply this test to only a small and limited quantity of a suspected solution, it would be necessary, or at least advisable, to first ascertain under what conditions a similar volume of solution of quinine of known strength would give a positive reaction with a given quantity of the bromine reagent, after proper dilution of the latter if necessary.

If an aqueous solution of chlorine, instead of bromine, be employed in the thalleioquin test, a positive reaction will manifest itself through a greater range than when bromine is employed, the result being less readily affected by excess or deficiency of the reagent.

In regard to the production of a red coloration, by treating the quinine solution, after addition of bromine or chlorine, and before adding the ammonia, with potassium ferrocyanide solution, as advised by Vogel, the results were less satisfactory than the test without the use of the potassium salt. With solutions containing more than 1-1000th of the alkaloid, a green or red or other coloration may be developed, the result depending upon the relative proportions of the reagents employed.

On treating 5 c. c. of a 1-1000th quinine solution with one drop of bromine water followed by one drop of potassium ferrocyanide solution (1:12) and a drop of ammonia, the result is about the same as without the presence of the potassium salt; that is, a white precipitate soon becoming green is produced. But, if under these conditions 0·2 c. c. of the potassium solution be employed, a portion of the mixture may be red and a portion green in color.

5 c. c. of a 1-5000th solution of the alkaloid under the action of one drop each of the reagents as above yields a fine green coloration. If, however, to this quantity of the quinine solution one drop of bromine water be added and then 0·5 c. c. of the ferrocyanide solution, the mixture, without the addition of ammonia, immediately assumes a deep red color. If a drop of ammonia be now added, the red color quickly changes to a beautiful purple.

5 c. c. of a 1-10000th quinine solution with one drop each of the reagents yields a fine red purple coloration which soon changes to green.

5 c. c. of a 1-20000th solution, under like conditions, yields a fine red coloration, which quickly fades to a light yellow color.

2. HERAPATHITE TEST.

This test was first proposed by Dr. Herapath, in 1852, and consists in the formation of quinine iodosulphate or herapathite, as it has been termed. This compound may be obtained by treating a solution of quinine in a mixture of strong acetic acid and alcohol, with an alcoholic solution of iodine. In a little time the iodosulphate separates out in the form of characteristic plates and rosette groups of crystals. By reflected light, the crystals are of a dark green color; under transmitted light they are dichroic and strongly polarize light.

The reagents may be prepared as follows: (a) Thirty volumes of strong acetic acid are mixed with ten volumes of strong alcohol and one volume of diluted

* Neues Jahr. f. Pharm., 1872. 139.

sulphuric acid (1:10). (b) One part of iodine dissolved in about twenty parts weight of alcohol.

To apply the test, a drop of the quinine solution is evaporated to dryness, and the residue treated with a drop of the first mentioned solution; a minute drop, or sufficient to color the liquid brownish-yellow, of the alcoholic solution of iodine is then added. Very soon portions of the mixture will present a dark green deposit, which when examined by a moderate power (75 diam.) of the microscope will be found to consist of the crystals in question. The formation of these crystals is perfectly characteristic of quinine.

The residue from one drop of a 1-100th solution of quinine, in the form of sulphate, when treated with a drop of the acetic acid mixture and then sufficient of the iodine solution to impart a strong color, will yield innumerable crystals of the iodosulphate compound.

A 1-500th solution residue will generally yield an abundant deposit of the crystals.

The residue from a drop of a 1-1000th solution, if simply moistened with the acetic acid liquid and then with a minute drop of the iodine solution, may yield satisfactory results; but it requires a nice adjustment of the reagents to obtain satisfactory results from this quantity of the alkaloid.

3. FLUORESCENCE.

One of the most striking properties, and at the same time the most delicate reaction of quinine at present known, is the fluorescence of solutions of its oxysalts, especially the sulphate. Normal solutions of the hydrochloride, hydrobromide, hydriodide and hydrocyanide present little or no fluorescence. A solution of the hydrochloride containing a limited excess of hydrochloric acid may, as pointed out by Prof. R. A. Witthaus,* present a well marked or even strong fluorescence, especially in dilute solutions; but this is permanently destroyed by a slightly larger quantity of the free acid.

When in solution as quinine normal acid sulphate, without excess of acid, and examined by ordinary reflected light in volumes of 50 to 100 c. c. the blue fluorescence is very intense in the 1-100th, 1-1000th, and 1-10000th solutions, and very well marked in a 1-50000th solution; but it is not apparent in a 1-100000th solution; and is only faintly marked even under a cone of condensed sunlight.

If 1 c. c. of the acid sulphate solution, placed in a small test tube, be examined, it will present as follows:

1. 1-100th solution, a very strong blue fluorescence in reflected light, which becomes intense in condensed sunlight

2. 1-1000th solution, a strongly marked fluorescence in reflected light; only feebly marked in direct sunlight; but intense in a cone of sunlight.

3. 1-10000th solution, a just perceptible fluorescence in reflected light; appears colorless in sunlight; intensely fluorescent in a cone of sunlight.

4. 1-50000th solution exhibits no marked fluorescence in either reflected or in direct sunlight, and only a faint fluorescence under a cone of sunlight. On the addition of a drop of dilute sulphuric acid, the solution presents a quite well marked fluorescence in condensed sunlight.

5. 1-100000th solution in condensed sunlight presents only a faint fluorescence; but on addition of a drop dilute sulphuric acid, the fluorescence is well marked.

The last mentioned degree of dilution is by no means the limit of the fluorescence of quinine solutions, under certain conditions. Kerner, by a specially constructed instrument, termed by him the *fluorescope*, was able to obtain the fluorescence beautifully marked in a solution of the alkaloid under a dilution of two million times.

It should be borne in mind that the fluorescence of quinine solutions, even of the sulphate, may be entirely prevented by the presence of chlorides, bromides and iodides, and the free acids of these salts. If to 1 c. c. of a 1-100th solution of quinine sulphate, which is strongly fluorescent, one drop of hydrochloric acid or of a solution of sodium chloride (1:10), be added, the fluorescence is immediately and wholly destroyed, and is not reproduced on the addition of even 0·5 c. c. of dilute sulphuric acid. The interference of bromine and iodine is as prompt and complete as that of chlorine.

According to the recent observations of MM. Sestini and Campani† the fluorescence of sulphuric acid solutions of quinine, especially when dilute, may also be concealed by the presence of phenacetine. According to these observers, this substance may also greatly interfere with the normal reaction of quinine with both chlorine and bromine in the thalleioquin test.

The property of fluorescence is possessed, although in a less degree, by some of the other cinchona alkaloids; and Dr. Bence Jones, of London, has described a substance normally present in the body, which has a similar property, and named by him animal quinoidine. Besides these substances, certain vegetable principles and extracts and the hydrocarbon oils present fluorescent properties.

4. TEST OF TASTE.

The intensely bitter taste of quinine and its salts may serve as a test of its presence. Of the ordinary preparations of quinine, the tannate is the least and the free alkaloid next least bitter; the normal sulphate is less bitter than the bisulphate, hydrobromide or hydrochloride.‡

The taste of the acid sulphate is very distinct and strongly marked in a single drop of a 1-10000th solution; and is still distinct in the same quantity of a 1-20000th solution; but according to several persons is not perceived in a drop of a 1-50000th solution.

In the very elaborate investigations of Dr. G. Kerner§ on the absorption and elimination of quinine, he found that when taken into the stomach in 0·5 gramme (7·5 grains) doses, it appeared in the urine fifteen minutes thereafter; and that one-half of the total quantity taken was thus eliminated in six hours, and one-fourth in the following six hours, but that a trace might still be present in the urine at the end of seventy-eight hours.

Of the quinine thus eliminated, Dr. Kerner found that a large portion had undergone a material change, in that while it still possessed fluorescent properties, responded to the reaction with chlorine and ammonia, and with chlorine and potassium ferrocyanide, it no longer had a bitter taste, it now being tasteless. By experiments he found that under the limited oxidation of quinine by potassium permanganate, a substance was produced which was tasteless and corresponded in every respect to this eliminated quinine. On analysis this oxidation product was found to be dihydroxyl quinine, having the composition $C_{20}H_{24}N_2O_2.2OH$. From these results Dr. Kerner concluded that it was under this form that the alkaloid, in part at least, appeared in its tasteless condition in the urine.

If, then, in the absorption of quinine or under oxidation, this change to the tasteless variety may take place, it is easy to understand that in the extraction of the alkaloid from the urine or the tissues, this important corroborative test might fail, even when the chemical tests indicated its presence. At present we have little or no experience in regard to the recovery of quinine from the body long periods after death.

That the alkaloids in general may undergo a slow and gradual change in the presence of decomposing animal matter seems to be fully established by the investigations of Profs. Buchner, Gorup-Besanez and others,* as well as our own observations, in the case of strychnine, which, under the conditions stated, after a time loses its property of responding to the color and certain other chemical tests, but still retains its bitter taste and the property of producing tetanic convulsions in frogs.

So also Dr. Pellacani,† on mixing a definite quantity of curarine with a given quantity of fresh blood and allowing the mixture to purify under favorable conditions of temperature, found after some months that the alkaloid no longer responded to the physiological test, although it still retained its chemical properties, except with the sulphuric acid test.

From our own experience, we are strongly led to believe that when morphine and strychnine are taken in moderate toxic quantity, that portion of the alkaloid which is carried to the tissues by the ordinary process of absorption entirely loses its property of crystallizing, even when present in quantity sufficient to promptly respond to chemical tests.

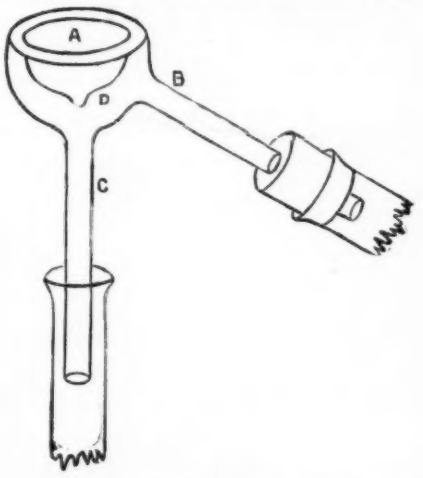
When the morphine or strychnine is taken in excessive quantity, a portion seems to be distributed to the organs by simple exosmotic diffusion, and this may readily be recovered in the crystalline state. In a case in which 1·68 grammes (about 26 grains) of strychnine were administered subcutaneously to a dog during a period of four hours, in divided doses, so as to keep the animal paralyzed, 56 mgs. of well-crystallized strychnine was recovered from the urine, 26 mgs. from the liver and 14 mgs. from the blood.

University of Pennsylvania, Medical Department.

A TEST-TUBE CONDENSER.

By C. J. BROOKS.

THE accompanying sketch of a small condenser for use with test-tubes will be found useful for separating



volatile substances on a small scale. The glass bulb, A, has a reservoir, D, in which the cooling medium is placed, on the cold inner surface of which the vapor will condense as it is driven from the test-tube through B. The condensed liquid then falls through tube, C, and is collected in another test-tube.—Chemical News.

NITROGEN TRIOXIDE.

ACCORDING to Nature, an important memoir concerning nitrogen trioxide, nitrous anhydride, N_2O_3, is communicated by Prof. Lunge and Herr Porschnew to the current issue of the Zeitschrift fur Anorganische Chemie. It is claimed that the investigation, whose results are now published, finally disposes of all doubt as to the existence of this much-discussed oxide of nitrogen. The main conclusion derived from the work is that nitrogen trioxide is a well characterized individual substance, which is readily formed under ordinary atmospheric pressure below the temperature of —21° by the union of nitric oxide NO and nitrogen peroxide N_2O_4, and constitutes an indigo blue liquid. It is stated to be perfectly stable at and below this temperature; but at a temperature slightly superior to this, even under pressure, it commences to decompose, and the dissociation is almost complete upon the conversion of the liquid into gas. Nitrous anhydride in a condition of purity thus appears to be incapable of existence in the gaseous state, while forming a comparatively stable liquid at temperatures below —21°. The gaseous product of dissociation, a mixture of nitric oxide and peroxide, exhibits similar chemical properties to those which might have been expected of gaseous nitrogen trioxide, hence of course the difficulty which has been experienced in deciding the question. It is pointed out, however, that the absolute incapability of existence of gaseous molecules of nitrogen trioxide is not proved, and the results of the investigation would appear to indicate that a residue of such molecules does escape dissociation upon the passage of the liquid into the gaseous state, and exists side by side with the molecules of the decomposition products. The experiments upon which these conclusions are based are mainly the following. It was first established that nitric oxide and nitrogen peroxide exhibit only the very slightest inclination to unite chemically at the ordinary temperature and at temperatures up to 100°. It was next found that at the temperature of —21° the two oxides combined in practically exactly molecular proportions to form the indigo blue liquid. The exact amount of N_2O_3 present in one of the specimens analyzed is stated to have been 98·3 per cent. The well known work of Ramsay and Cundall upon the subject is, of course, quoted, and it is stated that the apparently small amount of absorption of nitric oxide by liquid nitrogen peroxide, corresponding to only 3·5 per cent. of N_2O_3, observed during that investigation, was due to the loss of weight by mechanical removal of a portion of the nitrogen peroxide in the stream of issuing nitric oxide. It was further demonstrated that the product of the action of oxygen upon nitric oxide gas behaves, particularly toward sulphuric acid, precisely like a mixture, which it probably is, of nitric oxide and nitrogen peroxide. Moreover, the vapor derived from liquid nitrogen trioxide is not stable toward oxygen, but becomes further oxidized until it is almost pure peroxide. The memoir will be found to include an admirable summary of the literature of the subject, together with the views of Prof. Lunge concerning the bearing of the main conclusions of the investigation upon the theory of the sulphuric acid manufacture.

INFLUENCE OF BOILING ON GLASS VESSELS.

THAT a boiling fluid dissolves alkali in glass is shown by the following experiment:

To 300 c. c. of distilled water, placed in an ordinary boiling flask, lime water was added, and after boiling and cooling titrated with decinormal HCl. On boiling for fifteen minutes 0·03 c. c. additional acid was required, and the same quantity on again boiling for fifteen minutes.

With larger quantities of liquid the error caused by boiling for fifteen minutes was so increased that the advantage of using a decinormal acid was quite lost. 700 c. c. of distilled water boiled for four hours in a new Erlenmeyer flask required 9·53 c. c. of $\frac{1}{10}$ N acid to neutralize the dissolved alkali. After continuing the boiling for fifteen minutes the reading was 10·22 c. c., rising to 10·92 c. c. when again boiled for the same length of time.

A Bohemian hard-melting potash glass offered about ten times the resistance of ordinary glass. After four hours' boiling 700 c. c. required 1·09 c. c. $\frac{1}{10}$ N acid to neutralize the dissolved alkali, rising after ten minutes longer boiling to 1·14 c. c., and to 1·16 c. c. after a subsequent seven minutes. Thus the amount of alkali dissolved by boiling liquids for not more than ten minutes in vessels of this kind of glass affects the accuracy of the result but slightly.

It was not, however, until he used vessels made of Dr. Schott's new Jena glass that the author was able to obtain perfectly satisfactory results in standardizing solutions. In a flask of this glass 700 c. c. of distilled water boiled for four hours used 0·13 c. c. $\frac{1}{10}$ N acid, which after eighteen minutes' further boiling became 0·18 c. c.—The Analyst.

PROTEID POISONS.*

PROTEID poisons have been obtained from both the vegetable and animal kingdoms. Thus among those obtained from plants, one may mention the proteids obtained from jequirity seeds, the proteid associated with or identical with the ferment papain of the papaw plant, and lupino-toxin from the yellow lupin.

The most important of the animal proteid poisons are snake poisons; the proteids in the serum of the conger eel and other fish; and proteid poisons found in certain spiders. Poisonous proteids are also formed during ordinary digestive processes in the alimentary canal of every one of us from the proteids taken in as food. The peptones and the proteoses or albumoses (intermediate products in the process of hydration of which the terminal product is peptone) are fairly powerful poisons. 0·3 gramme per kilogramme of body weight injected into the blood will kill a dog, producing a loss of coagulability of the blood, a fall of blood pressure, a stoppage of secretions, and ultimately death by cessation of respiratory activity. Normally, animals are protected from this poison by the lining membrane of the alimentary canal, so that no proteose or peptone is found in blood or lymph even during the most active periods of digestion. The cells of this membrane possess many remarkable properties, but one of the most important is this power of regenerating albumen from peptone.

Allied to the albumoses of ordinary gastric activity are the similar products produced by bacteria. The way in which bacteria produce disease has long been a matter of dispute, but the problem appears to be approaching solution. Pathologists have at last turned their attention to the chemical side of the question, and shown that whereas in some cases the poisons produced by the growth of micro-organisms are alkaloidal in nature, in by far the greater number the toxic product is a proteid. The one which is best known, or at least attracted most attention, is the toxalbumose contained in Koch's tuberculin.

The foregoing list is far from complete, but one cannot conclude it without mentioning another class of proteid poisons: these are the nucleo-albumens obtainable by suitable methods from most of the cellular organs of the body. Originally discovered by Wooldridge, they were named by him tissue-fibrinogens, because they possess the remarkable power of

* Researches Loomis Laboratory, 1892, 91.

† Jour. Chem. Soc., Abs., May, 1892, 665.

‡ Prescott's Organic Analysis, p. 127.

§ Archiv fur Physiologie, ii., 1869, pp. 200-243; iii., 1870, 93-165.

* Ann. d'Hyg., 1881, 385.

† Rivista Sper Med. Legal, xiii., 2, p. 237.

* Extracted from an article on "Snake Poison," by Professor W. D. Halliburton, F.R.S., in Science Progress.

producing coagulation of the blood within the blood vessels of a living animal. A very small dose will kill a rabbit or a dog, and death is as a rule produced by extensive clotting within the vessels, especially in the veins. Under certain conditions, however, especially in the dog, they produce the opposite result, namely, a loss of coagulability similar to that produced by peptone. Wooldridge termed this the "negative phase of coagulation."

A practical outcome of all this work is the discovery of alexines or protective proteids. These appear to belong to the nucleo-albumen class also. In small doses they confer immunity on animals to larger doses of similar poisons, and thus the long-hidden secret of the modus operandi of vaccination and other forms of protective inoculation is at last beginning to be unraveled.

[FROM THE BULLETIN OF CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION.]

PEACH YELLOWS.*

By L. H. BAILEY.

THERE is no disease or difficulty of fruit trees in New York State which is the subject of so much misapprehension as the yellows of the peach. Not only are the origin and course of the trouble obscure, but the disease itself is frequently not recognized as a distinct and fatal malady, but is confounded with any weak or yellow condition of the tree. The name of the disease is unfortunate, since it leads people to regard yellowness as one of the first and indisputable symptoms of yellows, while, in fact, the disease may become well seated and may show its unmistakable symptoms in trees which are dark green and robust. It is for the purpose of enabling fruit growers to distinguish the true yellows from a multitude of other ailments that I have prepared the present report.

It should first be said that the yellows is generally spread throughout the State. I have made a careful study of the peach industry of Western New York during the present season, and I have run upon the yellows in almost every region which I have visited. It is particularly bad in Niagara County, which is the leading peach section of the State. It also occurs along the central lakes, in the Hudson River valley, and, no doubt, wherever peaches are grown to any extent. Yet the disease is not also so serious in certain regions as people have supposed it to be. I have visited orchards which were said to be dying with yellows, and have found only borers and that sublime neglect which characterizes so many peach orchards of the State. Orchards which are never cultivated or pruned or fertilized soon become sad-looking objects, making little growth and that of a feeble and yellow sort, and the borers hold unmolested carnival. In such cases, the first remedial treatment must be applied to the owner, for unprofitable or diseased orchards cannot cure themselves.

Fruit growers should know that peach yellows is a distinct disease, with characteristic symptoms, that it attacks the very best and strongest trees of the orchards as well as the weak ones, and that its end is always fatal. I have sometimes thought that the most vigorous trees are most liable to attack. It is certain that orchards in otherwise prime condition may be completely swept away with the yellows.

The most lamentable circumstance connected with the yellows in this State is the legal complication which arose in Niagara County† in 1889, when an attempt was first made to enforce the law which demands that yellows shall be eradicated. Commissioners were duly appointed and they proceeded with their duty of examining orchards and marking diseased trees. There was little general or popular knowledge of the disease, and the commissioners consequently met with opposition. It was charged that they marked trees which were not diseased. Whether this is true or not, it transpired that a certain peach grower refused to cut the trees which the commissioners had designated. Under the law, the officers cut the trees, but the owner refused to pay costs, and the people brought suit against him for misdemeanor. The trial was long and stubbornly fought. The trees which had been cut were destroyed, and there was therefore no evidence to prove that the trees in question had had the yellows. Much testimony of a general nature was admitted by the court as a matter of general interest and education, but the question which went to the jury was the specific one concerning the defendant's trees. The jury disagreed, and the defendant was acquitted. The result was regarded as a great victory by those who opposed the operation of the law; and it has had the effect of discouraging further efforts toward its enforcement in that county. The outcome has been most disastrous. The yellows is now widespread throughout the region which is naturally the best peach section of Western New York, and the dying and neglected orchards of careless peach growers are a constant menance to the peach industry. It will never be known, beyond the parties immediately concerned, whether the trees over which the suit occurred had the yellows; but I have this year visited the neighborhood which was the scene of the conflict and I found orchards ruined by the disease. Any law is impotent unless it is sustained and enforced by public sentiment. Every farmer should understand that peach yellows is a fatal and communicable disease, and that it is, therefore, amenable to control by the police powers of the commonwealth. Like pleuro-pneumonia and tuberculosis, it is a public nuisance.

When the yellows attacks a bearing tree, the first sign of its presence is usually in the fruit. The one unmistakable symptom in the fruit is the presence of bright red spots which may be likened to measle blotches, and the flesh is also more or less marked by red spots and streaks which often run through to the pit. When the attack is slight, these red streaks in the flesh may be faint or even almost absent, but the external spots are characteristic. The illustration (Fig. 3) shows a diseased peach. In addition to these marks upon the peach, the fruit generally ripens prematurely, although I have seen cases in which the spots were present upon fruit ripening in its normal season. On the other hand, yellows peaches sometimes ripen six weeks in advance of their season, particularly after the disease has run a year or two. Mere prematureness is not an indication of yellows. I have repeatedly been shown trees, during the past season, which were said to have yellows because the fruit ripened prematurely, but which were suffering only from borers, neglect or drought. These peaches lacked entirely the bright red spots of the yellows. Yellows peaches are usually poor in quality, particularly in sweetness; yet when the attack is recent and the fruit is not markedly premature, the quality may not seriously suffer. In the second year of the visible attack, however, the quality of the fruit is perceptibly low.

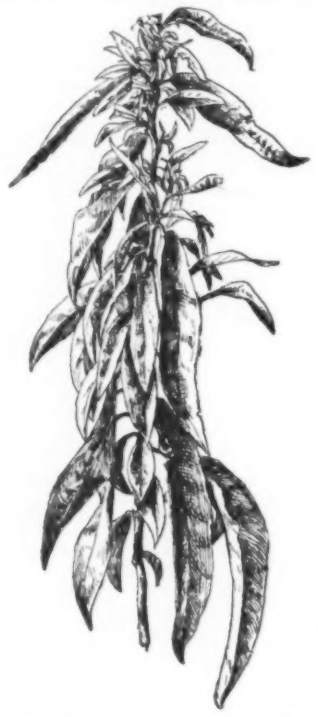


FIG. 1.—YELLOWS "TIPS."

FIG. 2.—HEALTHY TERMINAL SHOOT.

Yellows generally appears at first upon a part of the tree only. Sometimes only one or two peaches may show any indications of the disease, and the tree may appear to be perfectly healthy. Whether the branch upon which these peaches are borne is removed or not, the disease will be found the following year to have spread, involving more branches and possibly the entire tree.

The second characteristic symptom of yellows—or the first in trees not in fruit—is the appearing of short, yellowish, unbranched shoots or "tips" upon or near the ends of the healthy branches. These sometimes appear upon the ends of lusty water sprouts, and in such cases I have seen them well developed even when the fruit showed no signs of disease. These little shoots spring from buds of the season, which under normal conditions would not have pushed into growth until the following spring. These shoots may appear as early as July or even June, but in the early stages of the disease they are usually not seen until late summer or fall. In this State, I see them first, as a rule, in September. When they appear at this date, they rarely grow more than three or four inches long. The leaves upon these yellows "tips" are small and narrow, yellowish, and they usually stand out stiffly at nearly right angles to the stem, contrasting strongly with the drooping healthy leaves below them. Sometimes several of the uppermost buds upon a twig will start out into this short stiff tip-like growth. This feature is shown in Fig. 1. Contrast this shoot with the healthy twig, taken from the same tree, shown in Fig. 2. These tips sometimes appear late in fall after most of the leaves have fallen. The winter buds simply expand their sickly leaves and the stem may make no growth. Fig. 4 shows such tip, appearing late in October. Occasionally one may see these tips expanding prematurely in earliest spring. Frequently, in this State, these tips are so little pronounced, even upon trees badly diseased, that they are likely to pass unnoticed; and in such cases one must rely very largely upon the fruit for a diagnosis of the disease. In rare instances, the blossom buds upon diseased shoots may expand in the fall.

The third symptom of yellows is the appearing of abnormal shoots along the larger branches or even upon the trunks. These yellows shoots generally appear earlier in the season than the tips, and may make considerable growth. They are marked by short and narrow leaves which stand at nearly right angles to the stem, as seen in Fig. 5. They rarely grow more than a foot in length in this State. But the most striking form of this third feature of yellows symptoms is the bunchy growth shown in Fig. 6. Ordinarily a healthy peach shoot does not branch as it grows, but makes a straight stem one year and branches the next year. These yellows shoots, in confirmed cases of the disease, may branch into several or many fine branchlets the very year in which they start. These tufted shoots may spring from old branches two and more inches in diameter, or even from the main trunk itself (Fig. 6). They often spring out with uncommon luxuriance from the stumps of trees which have been cut with yellows. These bunchy growths rarely appear before the third year of the disease in this State, and in the great majority of cases of yellows which I have seen in New York they are wholly absent, even in the final stages. They appear to be less abundant in dry years. It is the first two symptoms—the red spotted fruit and the "tips"—which must generally be relied upon in this State for the diagnosis of the yellows; and even the tips, as I said, may be so little developed as not to attract attention. The one unmistakable and invariable symptom of the peach yellows is in the fruit.

The fourth and final stage of the disease is that in which the entire tree assumes the narrow, yellow or reddish and rigid leaves, and in this condition the tree is not readily distinguished, by the novice, from trees which are much debilitated by borers or neglect. The length of time from the outset of the disease at which this final stage and the death of the tree occur is not a fixed period. It is undoubtedly modified by many conditions. From the time when the first symptoms appear, it is not less than three years before death occurs, and it is oftener five or six years. But death is sure to come sooner or later, for there is no indisputable case on record of yellows having been cured.

There is abundant proof that yellows is communicable from tree to tree. Sooner or later, every peach tree in any community in which the disease appears may be expected to die from it, unless rigorous measures are taken to keep it in check. The disease is so insidious and often so slow in its progress that it usually becomes thoroughly established in a community before it attracts attention, and peach growers generally procrastinate in applying restrictive measures. It is unknown how the yellows spreads, but it is not through the soil, for young trees may be set with safety where yellows trees have been removed. Neither is it always, if ever, conveyed from flower to flower, for trees which have not yet blossomed often contract the disease. It does not inhere in the roots, for trees grafted upon plum stocks contract it. There is every reason to believe,

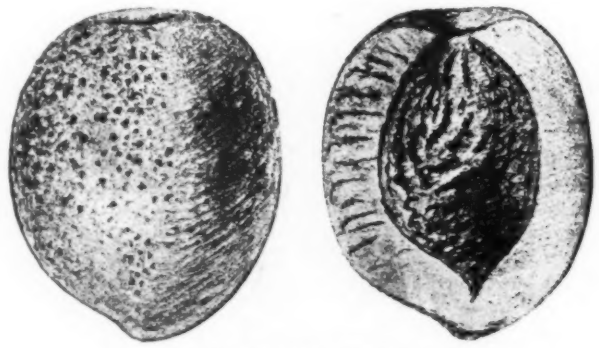


FIG. 3.—YELLOWS PEACH.

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* Those who desire to make a more particular study of peach yellows should consult the following publications of Dr. Erwin F. Smith, who is the recognized authority upon the subject:

"Peach Yellows; A Preliminary Report." Bull. 9, Div. of Botany, Dept. Agric., 1888.

"Additional Evidence on the Communicability of Peach Yellows and Peach Rosette." Bull. 1, Div. Veg. Pathology, Dept. Agric., 1891.

"The Chemistry of Peach Yellows." I. and II. Proc. Amer. Pomol. Soc., 1889 and 1891.

"Peach Yellows." Report of State Hort. Assoc., Penn., 1893.

"Experiments with Fertilizers for the Prevention and Cure of Peach Yellows." Bull. 4, Div. Veg. Pathology, Dept. Agric., 1893.

"Peach Yellows and Peach Rosette." Farmer's Bull. 17, Dept. Agric., 1894.

† Annals of Hort., 1889, 70.

also, that it is not carried on pruning tools. The means by which the disease spreads will probably not be known until the cause of the trouble is ascertained. Respecting this cause, there has been distinct progress in eliminating almost every origin which has been ascribed for the disease. It is known that yellows is not due to conditions of soil or climate, to mechanical injuries, to over bearing or starvation, to methods of propagating, pruning or cultivating, to insects or fungi, and Dr. Erwin F. Smith, of the national Department of Agriculture, who is the recognized authority upon the disease, now declares that "it is almost certainly not a bacterial disease." Dr. Smith thinks that the disease is "nearest allied to that phenomenon in plants known as variegation." It has been long known that most variegation is an abnor-

4. *Yellows "tip" appearing late in October.*

FIG. 4.—YELLOWS "TIP" APPEARING LATE IN OCTOBER.

mal state or condition and that it can sometimes be communicated to normal plants by means of budding; but it is difficult to conceive of any means by which such condition can become contagious without the presence of germs.

But there is every reason to expect that when the cause of the yellows shall have been discovered the treatment will remain the same as now—extermination of the affected trees. This seems to follow, from the fact that when the first symptoms of yellows are discovered upon any branch, the entire tree is diseased. Numerous critical experiments have been made to determine this fact, by cutting off the diseased limb. In every case the remainder of the tree has shown yellows, usually the following year, but sometimes not until the second year. And these results are exactly in line with the experience of all peach growers who have had to deal with yellows. It will also be necessary to exercise the same caution in the choice of buds for propagation, for it is known that a bud from a yellows tree—even from that part of a tree not yet visibly affected—will make a yellows tree and will communicate the disease to the stock. Premature yellows peaches rarely have good seeds, but the pits from the apparently healthy portions of diseased trees may be expected to convey the disease to the offspring.

So far as known, peach yellows, like pear blight and plum knot, is a purely American disease, and has not been introduced into other countries. It is generally

FIG. 5.—YELLOWS SHOOT.

distributed in peach sections east of Mississippi River and north of North Carolina and Tennessee. It first attracted attention about a hundred years ago in the neighborhood of Philadelphia, whence it appears to have spread throughout the country. It was probably introduced into the peach region of southwestern Michigan, where it appeared nearly thirty years ago, by diseased Eastern stock. As near as I can learn, it appeared in Niagara County, New York, about twenty years ago. The disease seems to prefer the peach, but it is known to attack the nectarine, almond, apricot and Japanese plums.

The only check for the spread of the yellows is extermination of the affected trees, and I doubt if a better method will ever be discovered. There is much

FIG. 6.—YELLOWS TUFT—One-half natural size.

difference of opinion as to when and how the trees should be removed. If but a single branch is affected and the disease shows only in the fruit, it is considered to be safe to burn the diseased branch and fruit at once, but to allow the remainder of the tree to ripen its crop. As soon as this crop is off, pull up and burn the tree, root and branch. If the disease appears upon a tree not in fruit—even if upon but a single branch of it—I should forthwith, as soon as the disease was discovered, pull out the tree and burn it. There is a tendency in this State to allow the trees to stand until fall work is done or until some other convenient season shall arrive; but growers who practice such methods are not long troubled with peach orchards.

This method of immediate extermination has been proved time and again to be completely effective in holding the disease at bay. The experience of the Michigan peach growers is often cited, and it is undoubtedly the best illustration extant of the effectiveness of timely and co-operative effort. The oldest commercial peach region of Michigan is that lying in Berrien County, in the southwestern corner of the State. Here the yellows first appeared. At that time, the disease was little understood, and growers temporized with it, and tried to cure it. As a result, the entire peach industry was wiped out, and small fruits, grapes, and truck gardening took its place. Lying twenty-five miles north of this St. Joseph region, and then separated from it by several miles of wild country, is the South Haven region. In this second region the disease finally appeared and destroyed a number of orchards, but the people, profiting by the disastrous experience of their neighbors upon the south, soon began a vigorous war of extermination against it. The local pomological society united the leading peach growers in the crusade, and the State legislature was prevailed upon to pass a law providing for the legal exercise of police powers upon the part of townships. This was probably the first American law aimed at a disease of plants, and from it have sprung the perfected laws of recent years relating to yellows, black knot and other diseases and insect pests. There were some growers of influence who resisted the law, but upon the whole the community was united in the one determination to checkmate the yellows. For a time the disease seemed to override all opposition, but it was finally checked, and it has not seriously interfered with the peach industry for the last dozen years. It is still present, however, and in certain seasons it breaks out with renewed vigor, but these recurrences are as vigorously met by the growers, and the disease again subsides. These years of renewed activity of the yellows are apt to follow years of comparative immunity, largely because of the less careful scrutiny by the yellows officers in the years of freedom from the disease. This determined fight against a common enemy has knit the peach-growing community together and has developed a local pride which is entirely absent in the peach sections of New York State. Public sentiment demands that no yellows peaches shall be shipped. A sign hangs in the warehouse at the port with this legend:

"All peaches left here infected with yellows will be destroyed and the owner prosecuted."

This sentiment is unknown to the New York peach growers, as a body. Everywhere I see yellows peaches on sale. These peaches are not injurious to health, so far as known, but they are inferior in quality, and the Michigan people have learned that the sale of them hurts their reputation and market. But the New York growers, as a rule, have not yet got beyond the point of asking if the diseased peaches are unwholesome, and have not risen to the plane of demanding that only good fruit, like pure milk, shall be allowed to make their reputation upon the market. And the clause of the law forbidding the sale of yellows peaches is practically a dead letter.

The success of the Michigan growers in stemming the invasion of yellows has revived confidence at St. Joseph, and that region is again growing peaches with its earlier eminent success. I do not expect equal success in eradicating yellows in this State, from the fact that the peach industry is nowhere extensive enough to make it the one absorbing interest of the community. As soon as it becomes the chief occupation of any region, the people will combine in self-interest to hold it in check. Yet the individual grower, if affected orchards do not adjoin his own, can keep the yellows at bay with a loss of only a few trees each year. There are such growers in Niagara County and other parts of the State, and their success should reassure all those who despair at the inroads of the yellows. But it must be remembered that the most painstaking vigilance is required to keep orchards healthy, and the best remedy for the evil will be found in the rigid enforcement of the law. No amount of arguing will stop the yellows. Fire is the only recourse.

Most of the laws aimed against peach yellows have serious defects. The most glaring of these is the fact that the owner of the trees has no appeal from the decision of the commissioners who are appointed to examine the orchards. There is always danger that incompetent or careless men may be appointed to the commissionerships, whose rulings may not be acceptable even to the best disposed citizens. The disease is so obscure that only the most careful and judicious men should be selected to diagnose it, and even at the best, there are men in almost every community who object to the destruction of their trees. Lack of confidence in the commissioners has been the most serious obstacle to the execution of the New York law, and it was at the bottom of the suit which occurred in Niagara County in 1889. There is a feeling also that the work of the commissioners in cutting trees is the invasion of a man's property without due process of law. All this is remedied in the Connecticut law—which is the best of all yellows laws—for the owner may appeal from the findings of the commissioner to the State board of agriculture, which "shall appoint a committee of three experts, which committee shall not include the person who, acting as commissioner or deputy, ordered such tree or fruit destroyed, and the decision of such committee shall be final."

Another difficulty with the laws is the danger that political considerations will prevail in the appointment of the commissioners. This danger is imminent whenever the commissioners are appointed by any officer or board which is itself a political appointment or creation. The difficulty can be averted only when the commissioners are created by a non-political board or office, as in Connecticut.

Other hindrances against the efficient operation of yellows laws are the inadequate pay given the commissioners—often rendering the appointment of thoroughly competent men impossible—and the lack of any general office or officer who shall keep records of the spread and control of the disease. This latter omission is serious, from the fact that it is only by a

study of careful statistics extending over a series of years that the progress of the disease can be accurately known and the effectiveness of remedial laws adequately measured. This important statistical feature has been embodied in the Connecticut law, and the yellows commissioner reports that in the year 1893 official examinations were made of 283,782 trees, of which 28,647 were condemned.

The full text of the Connecticut yellows law is as follows:

SECTION 1. The State board of agriculture shall, within thirty days from the passage of this act, appoint a commissioner on peach yellows, to hold office during the pleasure of said board. Said commissioner may, with the approval of said board and under the provisions of this act, adopt and carry out such plans as may be deemed necessary for the eradication of the disease, common to peach trees, known as peach yellows.

SEC. 2. At all joint meetings of said board and said commissioner, for the purpose of conference, the commissioner shall receive pay from the board for his expenses only. Said commissioner may, with the approval of said board, appoint one or more deputies in each county; and when employed in the performance of duties imposed by this act, said commissioner and his deputies shall receive from the State, upon presentation to the comptroller of bills duly sworn to, audited by the auditing committee of the board of agriculture, and approved by the governor, five dollars per day and their expenses.

SEC. 3. Any peach, almond, apricot, or nectarine tree diseased by the yellows, and all fruit from any such diseased tree, is hereby declared a public nuisance, and it shall be the duty of said commissioner or any deputy, under such regulations as the State board of agriculture may adopt or approve of, to order such trees or such fruit destroyed, and upon the failure of the owner to obey such order, to destroy such trees or fruit, and no damage shall be paid to such owner on account of such destruction.

SEC. 4. Any person may, when ordered to destroy any tree or fruit condemned by the said commissioner or deputy, appeal to the State board of agriculture, and said board shall appoint a committee of three experts, which committee shall not include the person who, acting as commissioner or deputy, ordered such tree or fruit destroyed, and the decision of such committee shall be final.

SEC. 5. Any person who shall, while such an appeal is pending, sell any tree from a nursery where there are found to be diseased trees, or any fruit from such tree, or who shall, without such appeal, or after such final decision, refuse to destroy such tree or fruit, shall be fined not less than one hundred or more than five hundred dollars.

SEC. 6. Any person that shall knowingly buy for the purpose of selling, or shall sell, or offer for sale, any fruit from such diseased trees, shall be fined not less than ten nor more than one hundred dollars.

SEC. 7. For the purpose of investigation or for the purpose of destroying trees or fruit known to be diseased, the said commissioner and his deputies may enter any premises; and any person who shall prevent or attempt to prevent such entry shall be punished by a fine of not less than ten or more than one hundred dollars, or imprisoned in a common jail not less than ten nor more than sixty days, or both.

SEC. 8. Prosecutions for violation of this act may be brought before justices of the peace, or any city, borough, town police, or common pleas court having criminal jurisdiction, by any prosecuting officer, or by the commissioner of peach yellows, or any of his deputies, and for such purpose said commissioner and his deputies shall have all the power of grand jurors.

SEC. 9. This act shall take effect upon its passage.

YELLOWS BREVITIES.

Yellows is a distinct disease. It attacks peach trees of all ages and in all conditions of vigor, seeming to have a preference for those which are thrifty. It is incurable, and its termination is always fatal.

The disease sometimes attacks the almond, apricot and Japanese plum.

Yellows has been recognized for about a century. It is peculiar to North America, and is generally distributed north of the Carolinas and east of the Mississippi.

It is communicable from tree to tree. The means of communication is unknown, but it is not spread through the soil, it does not originate in the roots, it is evidently not conveyed from flower to flower, and it is probably not transferred by means of pruning tools.

The cause of the disease is wholly unknown. Almost every ascribed cause has been disproved upon careful investigation.

It has no uniform preference for varieties, soils, climate, nor methods of propagation or cultivation.

No fertilization of the soil will cure the disease or check its spread.

The one unmistakable symptom of yellows is the red spotted character of the fruit. The flesh is commonly marked by red lines or splashes beneath the spots. These peaches generally ripen prematurely, and in the second year they are usually smaller and often more fuzzy than the normal fruit. The second symptom to appear—or the first in trees not in fruit—is the "tip" growth. This is a short growth starting from the upper or terminal buds, usually late in the season, and is characterized by narrow stiff yellowish small leaves which stand at nearly right angles to the shoot. Sometimes these tips appear late in autumn, after the leaves have fallen, or in spring before normal growth begins. They are often first seen upon the ends of watersprouts. This "tip" growth is sometimes little pronounced, and then only a practiced eye will detect it.

The third mark of the disease is the pushing out of slender stiff-leaved yellowish shoots from the body of the tree or the sides of the large limbs. In pronounced cases, or when the tree is about to die, these shoots may branch into close bunchy tufts. These symptoms are frequently wholly absent in this State throughout the entire course of the disease.

In its final stage, the disease is marked by small and slender growth of all new wood, small, narrow, yellow or reddish foliage, and occasionally by a great profusion of slender and branchy growths in the center of the tree.

As a rule, yellows trees die in five or six years from the first visible attack.

The yellow and stunted condition following neglect or the work of borers—both of the common borer and the pin hole borer—is often mistaken for yellows.

Extermination of all affected trees—root and branch—is the only method of keeping the disease at bay. This work should be prosecuted vigorously and systematically and with the full support of the entire community.

Trees may be set in the very places from which yellows trees have just been removed, with entire safety.

The disease is readily communicated to nursery stock by affected buds, even by buds from those branches of affected trees which do not yet show any signs of the yellows.

Pits from affected trees—when visable—may be expected to propagate disease.

CYPRIPEDIUM CYRIS.

A BOLD hybrid, with heavy claret-colored spots on a greenish ground; the dorsal sepal has a white margin and a green ground, with an abundance of spots; petals green, shading to rose, and also heavily spotted; lips deep rosy purple. F.C.C., R.H.S., November 13. Norman Cookson, Esq., Wylam on-Tyne.—We give an engraving from the Gardeners' Magazine.

VEGETABLE WAXES.

THE principal centers of vegetable waxes (China, Japan, and Central America) annually export very large quantities of these products, which are now used in a large number of industries.

The port of Ichang alone, in China, exported in 1889 more than 1,600,000 pounds of insect wax, of a value of $500,000. The export of Japan wax, which began hardly thirty-five years ago, is estimated to-day at several million pounds.

The wax trade distinguishes ten kinds of vegetable waxes, including the products known as vegetable tallows, viz.:

Carnauba or Brazilian Wax.—This wax coats the leaves of the wax palm (Copernicia cerifera) tree, widely distributed through Brazil and Paraguay. It is a singular tree, whose naked trunk often attains a height of 50 ft., with wide palmate leaves. The wax exudes upon the surface of the latter in small scales that may be detached through a friction of the dry leaves. This,

CYPRIPEDIUM CYRIS.

however, is not the way in which the wax is collected. The young leaves are cut off, dried, bruised in a mortar, and the wax is extracted by fusion. Carnauba wax comes in hard, brittle masses of a greenish yellow color. Its specific weight is about 0·999, and its melting point is from 83° to 84° C.

In the country of its production it is melted with tallow and used for making candles. In Europe and the United States large quantities of it are used for the manufacture of varnishes, oil cloth, and impermeable fabrics. It is employed also for hardening beeswax, varnishing and polishing cabinet work, floors, etc., and as an insulator for electric conductors.

Chinese Insect Wax or Pe-la.—According to a United States consular report, the principal center of production of this wax is the province of Sze-Chuen, and especially the valley of Tchien-schan and the banks of the river An-ning.

The tree upon which the larva of the wax insect develops, and the Chinese name of which signifies "ever green," is covered with thick, opposite, oblong-oval, persistent leaves.

In spring, the branches and branchlets become covered with small pea-shaped excrescences or galls, that are filled with a farinaceous mass formed by the larvæ of the wax insect (Coccus pela). These galls are gathered toward the end of April and sent to the prefecture of Chia-Ting in packages of about 15 ounces each. They are preserved as much as possible from the heat, in order to prevent the premature hatching of the insects, which, a few hours after their metamorphosis, try to escape through the fissures in the packages. In the vicinity of Chia-Ting there is a plain covered with knotty trunks from 4 to 12 ft. in height. At this epoch of the year, these trunks put forth numerous branches. This tree is probably the Chinese ash. The natives call it paila-shu, or "wax tree." The larvæ, to the number of from 20 to 30 in a package, are fastened under the leaves of this tree. Here the insect hatches out and remains stationary for a fortnight, after which it spreads over the branches and branchlets, upon which the females arrange the cocoons which the males are to cover with a protective coating of wax. The first appearance of the wax at the lower part of the branches resembles a deposit of light snow, but the layer soon increases in thickness and finally covers the branches with a uniform coating. Three months after the putting of the larvæ in place, the manufacture of the wax is considered as finished. The branches are then cut off and boiled in water. Each pound of larvæ produces from 4 to 5 pounds of wax. The wax, which is brown, is melted and run into moulds. At Shanghai, the great market for insect wax, the refined product is quoted, on an average, at 50 cents a pound.

Insect wax is the object of a very large trade in China. Only a small part of the crop is exported, the greater part being used in the country for forming a but slightly fusible coating for tallow candles. It is used also for finishing silk and for polishing laces and stones.

For some years past, this wax has found favor in some foreign markets, especially in those of the United States.

Japanese Wax.—This wax is extracted from the Rhus succedanea, a tree somewhat resembling the European elder, and which attains a height of about 40 ft. It produces fruit of a greenish brown color, of the size of cherries, from which the wax is extracted. The fruit ripens in October and is collected in large wooden receptacles, in which it is decorticated by pounding it with wooden clubs. The kernel, which is bean-shaped, is exceedingly hard, of a dark yellow color and soapy to the touch. These kernels are softened by steam and expressed.

The crude wax is in masses of a blue green, and is employed in the country for different purposes, principally for the manufacture of candles. For export, it is refined by boiling it with the lye of ashes until it is melted. It is then poured into cold water, where it hardens in small shells that are exposed to the sun for a fortnight in order to bleach it.

Thus refined, the Japanese wax presents a close resemblance to white beeswax in color, consistence, and fracture, all characters that would permit of confounding it with the latter. But there is one character in which it differs: while beeswax, when melted, emits an agreeable aromatic odor, the Japanese wax under the same circumstances disengages a repulsive odor of fat.

It is prepared for export in the form of large rectangular blocks, weighing 140 pounds each.

The fresh fracture of the refined wax is white, sometimes marbled with light greenish yellow. The ordinary qualities are of a more or less dark yellow color. The recent wax melts toward 42° C., but its melting point gradually rises to 52°-53° C. It is a little heavier than water. It is very soluble in alcohol at a temperature of 97°, from which it separates almost wholly upon cooling. Warm ether dissolves it in abundance, and from this, upon cooling, it separates in flakes or granules.

The preparation of this wax is one of the principal industries of Kinsin. The best product is manufactured at Kumamoto, but it is not commercial, it being reserved for the uses of the imperial court. The most esteemed commercial sort is prepared in the province of Hizan, and is shipped from Osaka to London.

Kaga Wax.—This wax is the product of the Cinnamomum pedunculatum. It is softer than the Japanese wax, and but little of it is met with in the European markets. The same is the case with the Ibota wax, the formation of which is due to the puncture, by an insect, of the bark of Ligustrum ibota. It is a very fine and white wax, exclusively consumed in Japan.

Candleberry or Myrtle Wax.—This product is obtained from plants of the genus Myrtus, which are widely distributed over the temperate regions of both hemispheres; in North and South America, Europe, Cape of Good Hope, Northern India, China, and Japan. The plants are mainly shrubs. The fruits are nuts covered with a waxy, resinous secretion, separated from the drupes by boiling them in water, skimming the wax from the surface, and then straining it through a coarse cloth in order to free it from impurities. Myrica cerifera and M. carolinensis are North American species, the last named of which is said to be the more valuable of the two. These plants yield wax of a greenish yellow color and of a finer consistence than beeswax, the production being at the rate of one pound of wax to four pounds of drupes. Candles manufactured from it diffuse an agreeable odor when burning, and even after extinction. There are several species of the genus found in Southern Africa, the wax from which is an article of export.

Palm Wax of New Granada.—The wax palm of New Granada (Ceroxylon andicola) grows in great abundance in the elevated regions on the chain of mountains that separate the rivers Magdalena and Cauca. The trunk of this palm is of great height and is covered with a coating of resin-like wax, which gives it a whitish, marble-like appearance. The wax is gathered by felling the plant and scraping the trunk with a blunt instrument, the average yield being twenty-five pounds to the tree. It is then melted and run into calabashes, in which state it forms an article of commerce among the inhabitants. It is much used for manufacturing candles, for which purpose it is mixed with tallow, since it burns too rapidly when used alone.

Stillingia Tallow.—The tallow tree of China (Stillingia sebifera), which has been naturalized in India and the warmer parts of America, bears fruits which are about half an inch in diameter and contain three seeds thickly coated with a fatty substance which yields a sort of tallow. This is obtained by steaming the seeds and then bruising them sufficiently to loosen the fat without breaking them. The fat is afterward made into large cakes and pressed in a wedge press, when the pure tallow exudes in a liquid state and soon hardens into a white brittle mass. This product is extensively used in China for making candles, but, as the latter get soft in hot weather, they generally receive a coating of the insect wax mentioned above.

Other vegetable waxes are yielded by the white gourd of India (Benincasa cerifera), the dwarf birch (Betula nana), a species of fig (Ficus cerifera), the wax tree of the Cordilleras (Elæagia utilis), etc.—Abstract from Moniteur Scientifique.

MADAGASCAR PIASSAVA.

(Dictyosperma fibrosum, Wright.)

FOR nearly twenty years a fiber closely resembling Brazilian piassava (described in Kew Bulletin, 1889, pp. 237-242) has been obtained from the island of Madagascar. It was moderately long, of a rich brown color, and evidently obtained from the stem of a palm as ordinary piassava. The quantity produced was never very large, and in the early stages of the enter-

prise the fiber was shipped in a very rough, uncombed state. Latterly the quality has much improved, and during the period when this class of fiber commanded specially high prices the shipments were probably remunerative. Owing, however, to the discovery of West African piassava or "bass fiber" obtained from Raphia vinifera (described in Kew Bulletin, 1891, pp. 1–5), the prices obtained for Madagascar piassava have apparently fallen almost as low as the cost of production; hence little of it has appeared lately in the London market. For the first specimen of Madagascar piassava, now in the Kew Museum (No. ii.), we are indebted to Messrs. J. Puddy & Co., of Mincing Lane. This was received in 1890. At that time the plant yielding it was not known. The more common palms of Madagascar, such as species of Hyphæne, Dypsis, Raphia, and Bismarckia, were believed not to yield this fiber. Hence it was inferred that there existed in the island a palm not yet described. This eventually proved to be the case. T rough the efforts of Messrs. Proctor Brothers, of East India Avenue, E. C., Kew obtained in 1890 specimens of the complete plant known locally as Vonitra, with stem and leaves showing exactly the manner in which the fiber was produced. Each plant had a slender stem about 5 ft. high and 2½ in. in diameter. This was surmounted by a crown of graceful pinnate leaves 5–6 ft. long. The whole stem, to the base, was thickly invested by a dense mass of fibers formed from the inner sheaths and edges of the petioles. The individual fibers were finer and more flexible than Brazilian piassava and also slightly shorter; in other respects they resembled it very closely. As to the commercial position of the fiber, Messrs. Ide & Christie are good enough to inform us: "Of late, Madagascar piassava has been well combed, straight, and clean, and in this state it is worth from £30 to £37 per ton; but as the quantities sent home, even at these rates, are small, we are led to conclude the preparation as now done is costly." The shipments are made from Tamatave and some of the ports to the south. In September, 1894, Madagascar piassava was reported to be "in demand," and the price had risen to £46 per ton. Fresh seeds were obtained from Messrs. Proctor Brothers, and from these numerous plants, now about 2 ft. in height, have been raised at Kew. They are nearest to Dictyosperma album, a well known ornamental palm from Mauritius and Bourbon, but are easily distinguished both from this and other species. Many of the plants raised at Kew have been distributed to botanical establishments in the colonies. Very soon the species will probably be well represented under cultivation.—Kew Bulletin.

[Continued from SUPPLEMENT, No. 988, page 15798.]

HALLUCINATIONS AND DELUSIONS.*

By WM. M. MCLAURY, M.D., New York City.

MR. ABERNETHY mentions a Frenchman who spent most of his life in England, and who for many years had lost the habit of speaking French, but while suffering from an injury to the head, again spoke only in his native tongue with readiness and fluency.

An inmate of St. Thomas' Hospital, in a state of stupor, in consequence of an injury to the head, on recovering his speech, spoke only a language that none of the attendants could understand.

The attending physician discovered it to be Welsh, which he had not spoken before in thirty years. On regaining perfect recovery he was unable to speak Welsh, and again spoke English.

Dr. Pritchard mentions a lady who, when in a state of delirium, spoke only a language which none of those around her could understand, which also was discovered to be Welsh. None of her friends could form any conception of the way in which she had learned this language, but after much inquiry it was discovered that, in her childhood, she had a Welsh nurse. She had never been known to speak it since her early childhood, till this attack of fever.

A German lady, married to an Englishman, and for many years accustomed to speaking English, during a certain illness was unable to speak except in German, which her English attendants could not understand, only as her husband acted as interpreter.

A woman, a native of the Highlands, Scotland, accustomed only to speaking English, suffered an attack of apoplexy. When she was so far recovered as to look around her, with an appearance of intelligence, the doctor could not make her comprehend anything he said to her, or answer the most simple question. He then desired one of her friends to address her in Gaelic, and she immediately answered.

Dr. Rush cites a case of a yellow fever patient in New York, who in the beginning of his illness spoke English, in the middle French, and on the day of his death only Italian.

A Lutheran clergyman informed Dr. Rush that a number of Germans and Swedes in his congregation when approaching death always prayed in their native languages, although some of them he was confident had not spoken these languages for fifty or sixty years.

Abercrombie relates a case of a boy who, at the age of four years, received a fracture of the skull, for which he was trepanned. He was trephined at the time, and after his recovery, retained no recollection of the accident or the operation. At the age of fifteen, when suffering from a delirium of fever, he gave his mother a correct description of the operation, persons who were present at it with the doctors, and other minute particulars. He had never been known to allude to it before, and no means were known by which he could have acquired a knowledge of the circumstances.

An eminent medical friend informs me that, during a delirium of fever, he on one occasion repeated long passages of Homer, which he could not do in health. Another friend mentioned to me that in a similar situation there were presented to his mind, in a most vivid manner, the circumstances of a journey in the Highlands, which he had performed long before, including many minute particulars, which he had long ago forgotten.

A surgeon riding home from a visit to a patient was thrown from his horse, and carried into a house in a state of insensibility. Consciousness soon returned. He described the accident distinctly, and gave minute directions in regard to his own treatment, one part of which was to be bled. He conversed sensibly and correctly with the medical man who visited him in the evening, was bled, returned to his own house, his medical friend taking him home in a carriage. As they drew near home, the medical friend made some observations respecting precautions to be taken with regard to preventing unnecessary alarm to the wife and family of the patient, when to his astonishment he found that the patient had lost all idea of having a wife or children. This condition continued during the following day, and it was only on the third day, after repeated bleedings, that the circumstances of his past life began to recur to his mind.

On the other hand, remarkable instances occur of the permanency made upon the mind, previous to such injuries, though the mental faculties are entirely obscured to all subsequent impressions.

Dr. Conolly cites the case of a young clergyman who, when on the point of being married, suffered from an injury on the head, by which intelligence was entirely and permanently deranged. He lived in this condition to the age of eighty, and to the last talked of nothing but his approaching wedding, expressing impatience for the arrival of the happy day.

A very dear friend of mine, on recovering from a long and severe illness, could recollect vividly and with indescribable satisfaction many events of her childhood life while visiting at the old homestead of her grandfather. She seemed to appreciate this even more vividly than the realities of her vigorous and buoyant youth.

It is chiefly in connection with attacks of an apoplectic nature that we meet with similar examples of loss of memory on particular topics, or extending only to a particular period. One of the most common is the loss of memory of words or of names, while the patient retains a correct idea of things and persons.

A patient of Dr. Gregory, after recovering from an apoplectic attack, could state correctly her ideas of things, but could not name them. In giving directions regarding family matters she was quite distinct as to what she wished, but could make herself understood only by going through the house and pointing to the various articles. A singular modification of this condition has come under my direct observation. A gentleman could not be made to understand the name of an object, if it was spoken to him, but understood perfectly if it was written for him.

Another frequent modification consists in putting one name for another, but always using words in the same sense.

One patient mentioned by Dr. Abercrombie uniformly calls his snuffbox a hogshead. The reason assigned for that was that in the early part of his life he had been in Virginia, in the tobacco trade, so that the transition from snuff to tobacco, and tobacco to the hogsheads in which it was packed, seemed to be natural.

Another gentleman affected in a similar manner, when he wanted coals to put on his fire, always called for paper, and when he wanted paper, called for coals, and these words he always used in the same manner. In other cases the patient seemed to invent names, using words which to a stranger were quite unintelligible, but he always used them in the same sense, so that his immediate attendants came to know what he meant by them.

A young lady suffered from a shock caused by the falling of a gallery of a church. She escaped without injury, but without a recollection of the circumstances of the accident, and this extended, not only to the accident, but to everything that had happened to her for a certain time before going to church.

A gentleman mentioned by Dr. Beattie, after a blow on the head, lost his knowledge of Greek, but did not appear to have lost anything else.

A few years ago I had a patient so hallucinated with the idea that he was under police espionage that he could neither eat nor sleep. He said that there were detectives on every corner watching to arrest or give evidence against him.

My efforts to convince him that this was only an impression on his mind, and not a reality, proved futile, until I took him in my carriage, drove over to the twentieth precinct station house, introduced him to Captain Washburn, and asked him if he knew the man, to which he replied, he did not. I said, "Captain, are you sure you have not detectives watching him? Are you sure that he is a good man? and that he does not require watching? If so, I want you to reassure him of the fact," which he did. This interview with the captain dispelled this hallucination. The patient slowly recovered by careful attention to diet and a few medicinal remedies for building up the brain and nerve power.

In a work entitled "Duality of Mind," the author relates a case of an intelligent, amiable man, who had the power of placing before him at will his own image. He often laughed at this eidolon, which also seemed to laugh at him. This was for some time a diversion, but the result was deplorable. This other self discussed obstinately with him, and to his great disgust often worsted him in the argument. At length, wearied with ennui, he resolved not to enter upon another year. He arranged all his affairs, with the utmost method, awaited, pistol in hand, the night of December 31, and when the clock struck midnight, shot himself.

Doubtless all present are familiar with the historical legend of Constantine: "Hoc Signum Victus" This is one of the myths of our religion, and they are numerous all along the line of Christian literature.

To illustrate this, we will cite Lord Herbert, who in writing his book on the "Falsity of Revealed Religion," devoted to it every spare moment he could snatch from business. In doubt as to its publication, he on one occasion prayed audibly for a sign to guide his decision, with regard to publishing it, and affirms that he had no sooner concluded his prayer than he heard a loud but agreeable sound in the heavens, proceeding from a clear sky. This gave him great joy, believing as he did that this was the sign he craved, approving of its publication. It may be remarked that the work in question was against, rather than favorable, to Christianity.

Semiramis saw everywhere the pale specter of Ninas, and Brutus was haunted by the apparition of his familiar friend Cæsar.

As every one will recollect, Brutus, at the Ides of March, surrounded by darkness and solitude, seeing vividly an apparition which he addressed, demanded an explanation of her intrusion upon his solitude, to which she replied, "I am thy evil genius. I will meet thee again at Philippi," where Brutus met his death.

In this apparition there is no reason to believe that the eye was imposed upon. The impression might have been made upon the brain, independent of the organ of vision.

Hatch cites a case of a young woman of twenty-four who could neither read nor write, who, while suffering from nervous fever, talked fluently, in Latin, Greek, and Hebrew, in pompous tones.

The priests and monks who visited her said she was suffering from demoniacal possession, and that the devil spoke through her. This possession was rendered more probable, as she had been a heretic.

A young physician visited her, wrote down hundreds of pages of her ravings, which were found to consist of sentences, coherent and intelligible, each by itself, but with little or no connection with each other. All trick or conspiracy in this case was out of the question. The young doctor traced back all her former life, and found that when she was about nine years of age, she was the ward of a Protestant clergyman, who had been in the habit for years of walking through the library and halls of his house, reading and reciting in a loud tone.

A great many inventors and men of genius perform their most wonderful exploits when on the verge of madness.

Dr. Rush says, talent for eloquence, poetry, music and painting, and uncommon ingenuity in several of the mechanical arts, are found involved in this mental condition.

He describes a female, patient who, while suffering from puerperal insanity, sang hymns and songs of her own composition during the latter part of her illness, with a tone of voice so soft and pleasant that he lingered and listened with delight, every time that he visited her. She had never discovered a talent for poetry, or music, in any previous part of her life.

It is a well-known fact that Edgar Allan Poe wrote "The Raven" while he was delirious.

Dr. Beasly says we observe in mad people an unsuspected resuscitation of knowledge; hence we hear them describe past events and hear them speak in ancient and modern languages, or repeat long and interesting passages from books, none of which we are sure they were capable of recollecting in a natural and healthy state of mind.

A young man, says Archbishop Bordeaux, was in the habit of getting up in the night, in a state of somnambulism, going into his study, taking pen, ink and paper, and composing and writing sermons. When he had finished one page of the paper on which he was writing, he would read it over aloud and correct it.

In order to ascertain whether the somnambulist made use of his eyes, the archbishop held a piece of pasteboard under his chin, to prevent him seeing the paper upon which he was writing, but he continued to write without being incommoded in the slightest degree. The paper upon which he was writing was taken away and another placed before him, but he immediately perceived the change.

He wrote pieces of music while in this state, in the same manner, with his eyes closed. The words he placed underneath the music. It happened upon one occasion that the words written by him were in too large a character, and did not stand exactly under the corresponding notes. He soon perceived the error, erased the part, and wrote it over with great exactness.

Gassendi tells us of a man who used to rise and dress himself in his sleep, go to the cellar and draw wine from a cask, while in a somnambulistic state. He appeared to see as well in the dark as on a clear day, but when he awoke, either in the cellar or in the street, he was obliged to grope or feel his way back to his bed.

When spoken to while in this state, he always answered as if he were awake, but in the morning recollected nothing that had happened.

Gassendi mentions a countryman of his who passed on streets over frozen torrents, in the night, but on awaking dared not return before daylight, or before the water had subsided. Somnambulism is believed to be hereditary.

Some time before the revolution, in the northwestern part of North Carolina, in what is now known as Asheville, there lived a family of the name of Porter. The head of the family one day was called away from home on business, and remained longer than was expected.

The wife, in her anxiety for her husband's safe return (for the surrounding country was infested with hostile Indians), kept a sharp lookout from day to day and, much to her joy, saw the well-known horse and rider coming into the yard. She waited a long time for him, and becoming uneasy, went to the stable. Much to her horror, she found neither horse nor rider. Then she retraced her steps, expecting at least to find traces of the footprints of the horse. But she was doomed to disappointment. Becoming alarmed, she aroused her neighbors, and they instituted a search for him. He was found in the woods, having been murdered by the Indians at the time she had supposed he had driven into the yard of his home.

Abercrombie, in his chapter on Spectral Visions, cites a case of Dr. Gregory's, in which the patient saw an old woman in a red cloak, who seemed to come up to him and strike him with her crutch on the head, at which he fell down in an apoplectic fit. This particular vision was noticed in each successive attack.

Dr. Ferrier mentions a case of a man who, while in a state of mental excitement, while awake, for several months was haunted constantly by figures of men, women, animals and birds.

Dr. Albertson mentions a saloonkeeper who saw a soldier endeavoring to force himself into a house in a threatening manner; when, on pushing forward to prevent him, he was astonished to find it a phantom. He had also a succession of visions of persons long dead, and of others who were living. He says: "I have known a patient describe distinctly a dance of fairies, on the floor of the apartment, and give most minute account of their figures and dresses."

A writer in the Christian Observer mentions a lady who, during a severe illness, repeatedly saw her father, who resided at a distance of many hundreds of miles, come to her bedside and, drawing the curtain aside, address her, in his usual voice and manner.

A medical friend relates a case of a relative of his

* Read before the New York Academy of Anthropology.—From the Alienist and Neurologist.

own, a lady of 50, who, on retiring one evening from a party, went into a dark room to lay aside some part of her clothing, when she saw distinctly before her the figure of death, as a skeleton, with its arm uplifted, with a dart in its hand. It instantly aimed a blow at her with the dart, which seemed to strike her on the left side. That same night she was seized with a fever, accompanied by symptoms of inflammation in the left side, but recovered after a severe illness. So strongly was the vision impressed upon her mind that even for some time after her recovery she could never pass the room where she saw the vision without becoming agitated.

Trains of thought bring up images to the mind which appear as real visions.

Dr. Gregory says of his father, who, having gone to bed with a vessel of hot water at his feet, dreamed that he was walking on the crater of Mount Ætna, feeling the ground warm under him.

He had visited Mount Vesuvius and had actually felt a sense of warmth when walking near the crater. It was strange the dream was not of Vesuvius instead of Ætna, of which he had only a description.

There are many cases which show the mind to be active while the body is asleep. Also that certain bodily functions may be dormant while others are alert.

The faculty of locomotion may be in exercise while the senses are in slumber, as is indicated by soldiers sleeping while on their march.

It is abundantly evident that the spirit is not only awake during the sleep of the body, but that it is constantly on the alert, and that it has a certain supervision over the body, so that it arouses into consciousness whenever it becomes necessary for so doing. A physician will not heed the cry from a child which instantly arouses the mother, but the slightest sound of his night bell will rouse him. He may get up, go out and return without his wife being aware of it.

When we fix a determination in the mind to awaken at a certain time the mind wills it and we awake, while if we trust another to waken us the mind relaxes its vigilance and fails to rouse the body. It is not on the alert for measuring time nor listening to sound. An alarm clock will awaken a person while louder noises in the street will be passed by unheeded. Any one unaccustomed to have another enter his room after his retiring will usually be awakened by his approach, however silent it may be.

Every phenomenon connected with the human constitution goes to show that man is a two-fold being, possessing an outward and an inward consciousness. The simplest and most common form of this is the ordinary sleep and the usual wakefulness. Between these two conditions he continually alternates and derives his rest, not from the state of unconsciousness, but by changing his conscious actions from one plane to another. His alternations of these forces, therefore, between the correlative planes of the outer and inner life, are to the human constitution what day and night, summer and winter, are to the planetary system.

A man may be thinking or reading in a perfectly lucid, conscious manner, but on closing his eyes his mind immediately reverts to other scenes and thoughts, and many times with more activity than in his wide-awake moments.

Dr. Read relates of himself, that after a blister on his head, having become irritated, causing pain, he dreamed of falling into the hands of savages and being scalped by them.

Every event must have a cause adequate to the result. Appearances showing a correct application of means to an end indicate design and intelligence in the cause.

Dr. Abercrombie says, by memory we retain the impression of facts and events. With recollection we recall them into the mind, by voluntary effort. By conception we recall portions of the impressions of casual scenes, persons or transactions; thus, a skillful painter can delineate from conception a landscape considerable time after he has seen it, or the countenance of a friend who is dead or absent.

These appear to be the leading phenomena which are referable to the head of memory. There seem to be original differences in the power of memory, some individuals being remarkable for retaining memory, though not otherwise distinguished by their intellectual endowments. Thus persons have been known to repeat a long discourse after hearing it once, or even a series of things, without connection, as a long column of figures, or a number of words without meaning.

There is a man on record who could repeat the whole contents of a newspaper, and of another who could retain words that were dictated to him, without any connection, to the amount of 6,000.

A man mentioned by Seneca, after hearing a poet read a new poem, claimed it for his own, and in pursuance of this claim, repeated the poem from beginning to end, which the author himself could not do.

A similar anecdote is told of an Englishman whom the King of Prussia placed behind a screen, when Voltaire came to read him a new poem of considerable length. The king derided him on claiming the authorship of the poem, and soon called the Englishman, who had overheard the reading of it, who repeated it word for word.

But these prodigies of memory do not manifest other intellectual powers to correspond. Though the mere memory of words may be met with in a high degree in persons of a defective understanding, it is true also that men of high endowments have to be remarkable for memory.

I have written something more on the effect of visions and dreams on peoples and nations as well as individuals, but I will not detain you further than to say that there is a universal law underlying all these phenomena. "There is a sufficient cause for every effect." Now if noting and tabulating these various mental phenomena will enable anthropological students to comprehend and understand this law, the objects of this paper will have been attained.

It is said that Themistocles could call the names of all the men of Athens, amounting to twenty thousand, and that Cyrus knew the name of every man in his army.

It is reported that the late Dr. Lyden was remarkable for his memory. It is said that he could repeat correctly a long act of Parliament, or any similar document, after once having read it.

When a friend congratulated him on his remarkable power in this respect, he replied that it was often a source of great inconvenience, as well as an advantage. This he explained by saying that when he wished to recollect a particular point in anything which he had read, he could do it only by repeating to himself the whole, until he reached the point which he wished to recollect.

I cannot conclude this paper without alluding, from an anthropological standpoint, to the wonderful influence that visions and dreams have had upon our race.

The establishment of religious creeds and dogmas of all nations have had for their origin and foundation the belief in these unsubstantial vagaries. Even the divine Plato was a believer in visions and dreams.

Dreams and visions comprise an important part of the sacred Scriptures. All inspired writers seem to have been impressed with the importance of these evidences of spirit manifestations. The Pentateuch, the prophets, the apostles, all dwell with minuteness of detail upon this phase of evidence of supernatural inspiration. Even the evidence of the dogmas of faith in the Christian religion largely rest on Mary's vision and Joseph's dream.

The Buddhists' faith is also visionary, but much more ancient and direct. In the Oriental faith, Buddha sustains the same relation to Brahma that Christ does to God. Correlatively, the Buddhists are the Christians and the Brahmins are the Jews of great antiquity.

The legend of the Buddhistic writers (of a time 600 to 1,000 years before the Christian era), as inscribed on the tablets and temples in India, is that Mai, a virgin of the ancestral line, having been impregnated by a ray of light from Deity, in due time gave birth to Gautama Buddha, who, by his deific parentage, became endowed with superhuman talents and powers.

He was enabled to heal the sick, cast out evil spirits, and even to raise the dead, and by special aid and dispensation from Brahma, the Father God, was enabled to struggle against and to destroy the Giant of Evil, for which he was surnamed Christna.

The legend then recounts many wonders, miracles and prodigies accomplished by him, and finally closes

UNIVERSAL ASTRONOMICAL CLOCK.

with the assertion that he died a martyr for the peace of mankind on earth.

The ancient faiths place Buddha synonymous with Vishnu, as the second person in the Brahminical trinity, Brahma Vishnu, Siva Vishnu, being the incarnation of Brahma, which the sacred books of the Hindoos declare will be reincarnated in seven separate atavors or manifestations to mankind.

UNIVERSAL ASTRONOMICAL CLOCK.

THIS clock and globe is composed of an ornamental base which is partitioned into two sections which are divided into twelve divisions. On this base rests a terrestrial globe with the names of places indicated in the usual manner. The hours of the day are painted white, those of the night black. The globe revolves by means of clockwork in the same manner as the earth, and makes one complete revolution around its axis in 24 hours. The apparatus runs for ten or twelve days like a clock. By this arrangement any point of the globe is situated exactly above its local hour, all others necessarily come above the hour corresponding to them, and this operation is kept up as long as the globe accomplishes one revolution around its own axis in 24 hours. The gilded hand, L, indicates the local time, and corresponds to a gilded meridian circle, I, which passes through the place where the owner of the globe lives. When one desires to know the time in any other place, it is only necessary to turn the globe until the place is before you, then turn slowly the whole apparatus, which is pivoted on its base, until the silvered meridian circle, M, passes through the center of the town or city, when the silvered hand, m, with which it is connected will indicate the hour at that place. The equator is represented by a gilded circle, E, divided into 360 degrees, of which 0 is fixed on the local meridian. At the same time we can read the latitude, the longitude, and the hour at all points of the globe. For our illustration and the foregoing particulars we are indebted to Les Inventions Nouvelles.

HIGHS AND LOWS IN THE ATMOSPHERE.

By H. A. HAZEN.

IT is intended in this paper to set forth some facts tending to answer the question, What are HIGHS (elevations) and LOWS (depressions) in the atmosphere? The term anticyclone for a high pressure area seems a misnomer, and the term cyclone, for a storm, first applied by Piddington to the violent storms in the seas north and south of the equator, should be used in connection with these storms. These terms here suggested apply exactly to what we see on our weather maps, and till we know more about the mechanism of these phenomena they may be regarded the most concise and satisfactory that can be used. The so called permanent HIGHS and LOWS, for example, the winter HIGH in Siberia and the perment LOW over Iceland, are not included in this discussion, nor are thunder storms, tornadoes, water spouts or any such phenomena included, since they are known to be secondaries usually 400 or 500 miles to the southeast of the center of a general LOW and have very few of its characteristics.

Every one is familiar with these HIGHS and LOWS as they move rapidly or slowly one after another across the country. We are taught that in a HIGH the air is denser and cooler; this has a tendency to cause a flow of air to its center and there to raise the pressure. If anything, there is a slight tendency downward in the air, and this also serves to raise the pressure. There is also a tendency to whirl from left to right. In a LOW the air is less dense, it is much heated, is full of moisture, and there is generally an uprush in the center as well as a whirl about it; all these conditions serve to diminish the pressure. Also the uprush at the center carries moist heated air to the cooler upper regions, and by expansion a still farther cooling is effected, which causes a condensation of the moisture and precipitation. This condensation, however, liberates latent heat, and this in turn heats the air and causes greater rarefaction, which in its turn causes a greater uprush, and this may continue till a most violent disturbance ensues. The fact that rain does not fall at the center, where Espy supposed it did, but 400 miles or more to the east and southeast in the United States, while in England a little more falls to the west than to the east of the center, would seem a serious objection to this view.

We may consider this whole question under several propositions:

1. Highs and Lows have a common progression or velocity.—This seems self-evident, for, if they had not, the one would overflow the other. It is not intended to imply that these conditions 2,000 miles apart, more or less, have a common velocity, but, as they pass along one after the other, their movement must be practically the same, and when the velocity of one changes, the other must also.

2. There is no whirl in either, a few thousand feet above the earth.—Observations of clouds have shown this fact beyond a doubt, but the records for over seventeen years at the station on Mt. Washington, N. H., 6,300 ft. in height, are absolutely conclusive on this point. There is no veering of the wind at this station such as is noted at the earth's surface; in fact, an east or northeast wind is a most rare phenomenon; over 90 per cent. of the winds are from a westerly direction. Some have gone so far as to declare that this proves that the centers of the great majority of HIGHS and LOWS must be below 6,300 ft. Imagine a disk 6,300 ft. high and 3,000,000 ft. in diameter whirling round and round, and at the same time carried horizontally from west to east. Suppose we heat up the front (east) part of the disk, how many minutes will it be before the whirl will carry this warmer part around to the west and bring the cooler to the east? Now we know that the east and southeast part of this LOW continues warmer than any other part, and the west and northwest cooler, a condition which would be impossible if there were a whirl.

3. The centers are far above our highest mountains.—This proposition is of great importance, and if it could be positively settled, would clear away many difficulties. It is thought by some that since in a LOW there is a great increase in temperature in the lower layers, there must be a relative increase in pressure as we rise in the atmosphere, and hence in a very short distance we would reach the so-called "neutral plane," above which there would be an increase of pressure. Observations show that no such condition exists, and that, on the passage of a LOW, the pressure falls just as much at Pike's Peak, for example, relative to its height, 14,134 ft., as at the base. This shows that the condition making the change in pressure is far above three miles in height. It will be shown shortly that temperature changes with HIGHS and LOWS on our highest mountains are exactly the same as at the base, and this also proves that the center of the condition producing the changes must be far above these mountains.

4. There is no movement of air or moisture particles by air currents in a vertical direction in them.

The theory of an uprush in a LOW is the most tenaciously held of any in meteorology. It is the primum mobile of all views of storm generation. There is not one scintilla of evidence that such an uprush exists except in imagination. One or two reasons for denying this have already been given, one other only is here noted from many. Since there is friction with the earth, the lower part of this uprush would lag far behind the upper, and in a very few minutes the verticality of the uprush, upon which alone its integrity depends, would be entirely obliterated and the whole movement quickly brought to rest. To say, as some do, that the upper part of this uprush separates off and goes gyrating ahead of the lower part, and afterward communicates its gyrations through a frictionless medium to the earth, seems very strained. Computation has shown that it would require over 20 years for such gyrations to pass vertically through 300 feet in a frictionless medium.

5. There is no extended horizontal transference by air currents of material particles in them.

This is probably the most important proposition of all that can be advanced, and it will be the one hardest to accept by those who have been taught that our LOWS are enormous whirls transported in the drift of the upper atmosphere. The truth of this proposition is shown by the fact that while the LOW travels, in the United States, in winter, at the rate of 35 miles per hour, the wind rarely attains half that, and even then the wind does not blow steadily from the west. It

is easy to see that if the wind were blowing at the rate of 35 miles per hour in front and toward the LOW, the velocity of particles in the LOW toward the east would just counterbalance this motion, while on the west side, if the wind blew straight toward the center, the velocity should be 70 miles per hour, but we know that the wind velocity is nearly uniform on all sides. Again, in a HIGH having the same velocity, about 35 miles per hour, there is almost a dead calm. In this journal for January 18 of the present year I have shown that one of the most important characteristics of a storm is an enormous increase in the dew point or amount of moisture over thousands of square miles in front, while there is as great a decrease in the rear. These effects are in nowise due to heat, winds, evaporation or any other cause acting at the earth. I have also found that the diminution in the rear cannot be due to the advance of a HIGH with cold dry winds, because it often takes place when that does not follow up the LOW.

It is probable that this drying takes place at some height in the atmosphere first and works down. Whatever it is, it cannot be due to the onward movement of air particles, now full of moisture and almost immediately after with the moisture sucked out, as it were. It is well known that it is one of the most difficult things to either saturate air or deprive it of its moisture.

It would seem as though such transference of particles were improbable, but it may be asked, how can the changes be brought about by the HIGH and LOW if they do not travel? May we not consider these phenomena the result of another action? Suppose we have two spheres 1,000 feet in diameter carried through the air at a height of 1,000 feet, the one very hot and the other very cold, and we had thermometers delicate enough to register changes in temperature of the air at the earth, the resulting phenomena would be exactly those that we now observe on the passage of a LOW and HIGH.

6. They are almost entirely independent of the drift of the atmosphere, though they may affect that.

It will be conceded, on all sides, that the clouds drift in the atmosphere. This drift is almost invariably from west to east, but we often notice our HIGHS and LOWS changing position from north to south. The best proof of this proposition, perhaps, is to be found in mountain observations. As a HIGH approaches, the drift or wind at the mountain station dies down and becomes about half the apparent motion of the HIGH, while with the approach of a LOW the drift increases to nearly double the motion of the LOW (see Journal of Franklin Institute, July, 1888). Now, as we have just seen, the progression of the HIGH is practically the same as that of the LOW, so that, if anything, the drift of the atmosphere is changed by the progress of HIGHS and LOWS instead of their motion being dependent upon the drift.

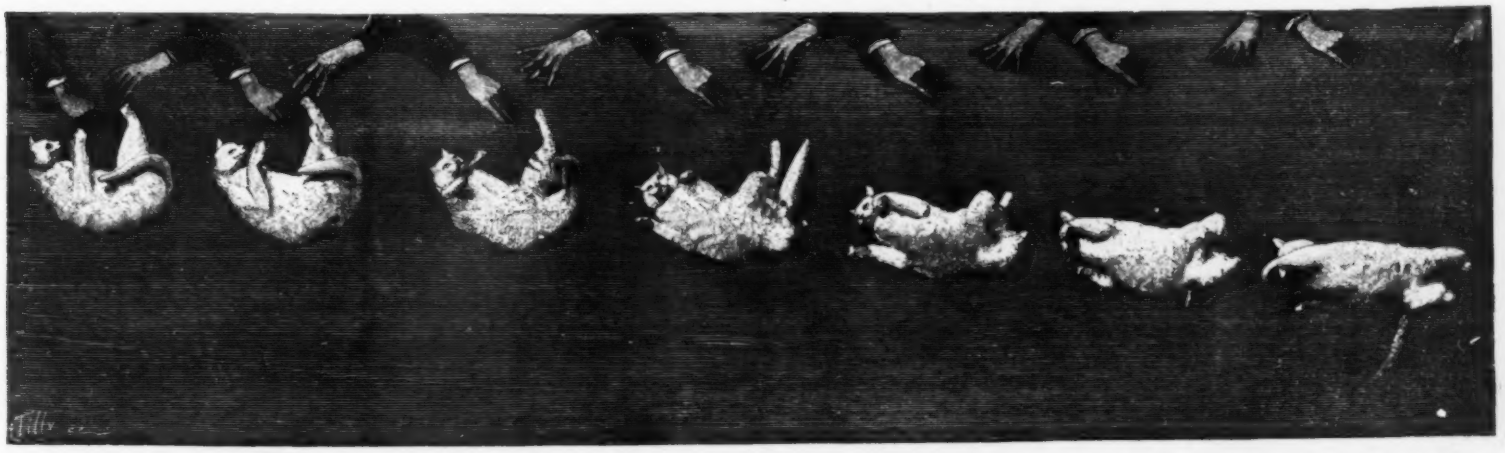
7. They are independent of temperature changes both above and below, and, in fact, bring about the latter.

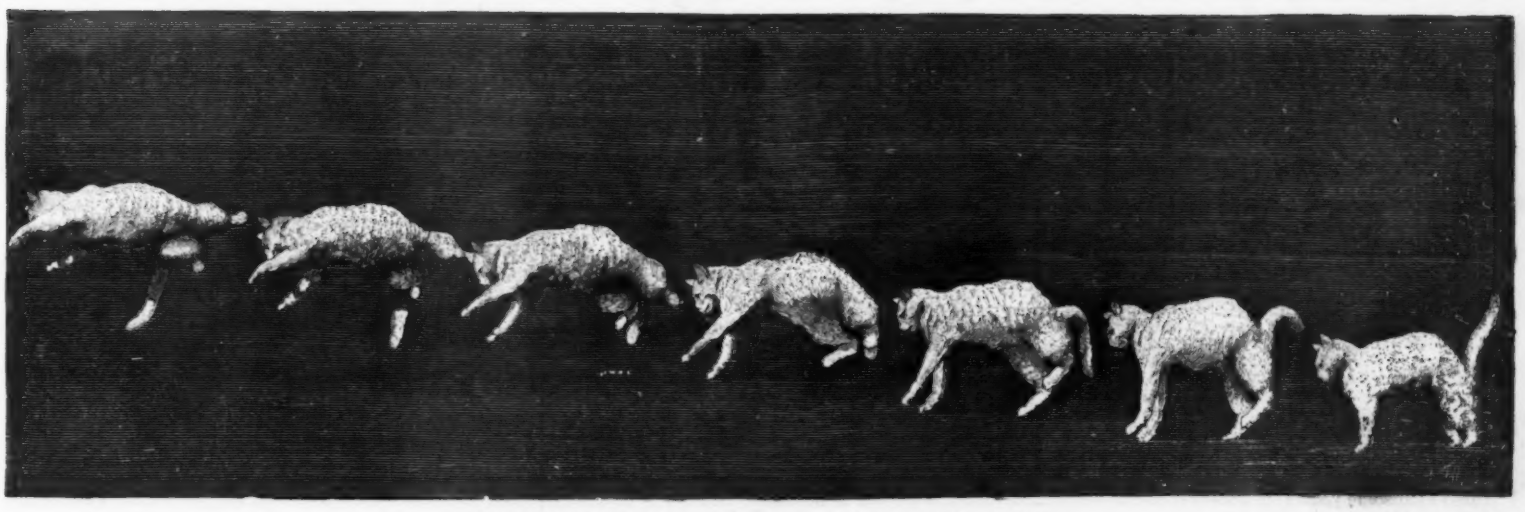
This proposition comes next to 5 in importance, and is really established by that. If it can be sustained, it gives the deathblow to most modern theories of the generation of the HIGHS and LOWS. We find exactly the same temperature changes at our highest stations as at the base, and hence it is very evident that the center of influence in the HIGH or LOW must be far above our highest station, or more than three miles above the earth. It is possible that the conditions producing our HIGHS and LOWS extend to the limits of the atmosphere. We are taught that the sun heats a limited portion of the earth, and this in turn heats the air, and the air above is heated layer by layer; while there may be a limited action of this kind, yet it is evident that that could not account for more than a small fraction of the heat in our LOWS, and it would not account at all for the cooling in the HIGH. Some think that the air near the earth becomes heated, and this starts a rush of air upward, but it is very evident that such a motion of a warmed particle cannot be maintained as we have seen under 4.

8. They are independent of direct heat influence from the sun.

This is plain in the case of HIGHS, since they show a lack of heat, and it is also true for LOWS, since they have a continued heat action through the night. The fluctuations in temperature on the advance of a LOW are much greater in winter than in summer, though it is plain that the sun's influence is very much greater in the latter case.

It will be seen at once that these 8 propositions are largely negative, and that we have advanced very little in our studies regarding HIGHS and LOWS. It is plain that nearly all of them are most intimately connected, and must stand or fall together. No attempt has been made to theorize, but it has been my desire to present facts as simply as possible. If any one has been led to think of these things, and will enter upon a discussion of this interpretation of the facts, I shall be entirely satisfied.





EXPERIMENTS WITH A FALLING CAT.

M. Marey was not convinced of the truth of this, and promised his colleagues to perform the experiment again, suspending the animal by a thread which should be cut when the exposure was to be made. M. Marey has not observed any contradiction of the facts which he observed, and natural laws, but only an erroneous interpretation of the laws by the savants. These laws oblige the acrobat when he takes his leap to take previously a point of support on the ground or the spring board, but we cannot consider the body as that of a cat, to be composed of two parts, one of which serves as a kind of spring board for the other. If we examine the photographs, we will see in the first four positions the animal arches his vertebral column and brings up his front feet to his head in such a manner as to show that the moment of inertia of the fore feet is inferior to that of the hind feet.

The rotation then begins, which is accentuated in position 8, when the cat, using the inverse procedure, extends its forelegs and shortens up its hind legs. Then, as soon as the hind foot has come around in its turn as in Fig. 11, the beast extends its four paws, Fig. 12, and as it touches the ground arches its back and raises its tail. In all these experiments it will be seen that the members take a point of support, but the body itself furnishes them, so that the experiment is not as paradoxical as it would appear. In the same manner a person learning to swim, when he is suspended in the air by a cord, finds in his own body the points of support necessary to permit of moving his arms and legs.

For our engraving and the foregoing particulars we are indebted to L'Illustration.

WHY A CAT IN FALLING LANDS ON ITS FEET.

THE Academy of Sciences has recently occupied itself with an interesting problem, so interesting, indeed, that the most celebrated men of science have discussed its solution. The question is this: "Why does a cat fall on its feet?" The hare, or rather a cat, has been experimented upon by Dr. Marey, a learned professor, who has made a specialty of the analytical study of movement by chronophotography, which bears his name. The photochronographic apparatus of Dr. Marey analyzes the movements of animals to perfection. He has already shown the various steps of the horse, the dog and the sheep, and now he has obtained by the same means the motions which a cat goes through in mid-air to drop on its feet. He took a tom-cat of immaculate whiteness, and after raising him the height of a meter, dropped him. This experiment was conducted before a photographic apparatus. In some hundredths of a second the fourteen positions, which we reproduce, were assumed.

When M. Marey submitted his proofs to the Academy of Sciences, the result of the experiments, so simple in appearance, one of the erudite members observed that here was a scientific paradox, a contradiction of the laws of mechanics. The cat could not turn himself without some point of support. The opinion most generally held was that the hands of the operator had unconsciously given the cat a kind of twist which assisted the cat in executing its perilous leap.

THE NEW YORK AQUARIUM.

THE pools in the aquarium at Castle Garden are now completed and in use. Some of the wall tanks are finished and work is going forward on the rest. It is hoped to open the aquarium by the last of December, but the opening may be delayed. When completed, the institution at Castle Garden will be one of the great aquariums of the world, if not the greatest. In its various appliances, it will be the most perfectly equipped, and it will probably have greater accommodations for a larger number of species than any other. The circular form of the building is familiar. It lends itself happily to the requirements of an aquarium and to the attraction and spectacular effect in the display.

On the floor there is one great central, round pool, 38 feet in diameter and 6 feet deep. Surrounding the great pool are six other pools, each 28 feet in length and 3 feet deep. These are oblong pools and conform in shape to the outline of the great central pool. The pools are built of hard red brick laid in cement, faced with red tiles. They are topped with a wide coping or rim of cut bluestone, and are lined with white porcelain tiles. All the pools and all the fixed tanks rest upon foundations of their own, so that they shall not be affected by any possible settling of the building.

There are ninety-four wall tanks, and of smaller glass tanks there will be a considerable number. The wall tanks are in two tiers, extending around the building, except upon the eastern or park side, where the

entrance is situated, and upon the western or seaward side, where the boilers and filters are placed. The ground floor tanks are built of brick, the gallery tier of slate; all are lined, like the pools, with white porcelain tiles. The lower tanks are from 5 to 7½ feet in width and 5 feet in depth. The upper tanks vary from 3 feet to 5 feet in width, and are 4 feet in depth. On the ground tier some of the tanks are joined in groups of two, making practically a single tank 10 feet in length. One looks over the rim into the pools; the fish in the tanks are seen through a front of plate glass. The tanks on the north side of the building are designed for fresh water fishes; those on the south side for salt.

The gallery platform is 10 feet or more in width. Except for supporting pillars, the central space of the building is clear from the floor to the lofty roof. On the eastern side of the building over the entrance are the office of the aquarium, another and larger room, which may be used for educational purposes, and perhaps for the display of fish in smaller tanks; and still another, a smaller room, which is to be used as a dissecting room. Back of the tanks, and between them and the outer wall of the building, is a wide corridor with ample space for the convenient handling of stock and the care of the fish in the tanks.

The pools are all for salt water. There are fish now in all of them, but there are none in the tanks. The fish in the pools are part of the stock now accumulating. The rest, and by far the larger part, are in storage in cars and floats at Gravesend Beach. There are now on hand either here or at Gravesend Beach specimens of nearly all the ordinary fish of this locality, and some rare fish, but nothing like the variety that will be on view after the aquarium is open.

The waters of the region adjacent to New York abound with life, not only in common, but also in strange and beautiful forms. H. T. Woodman, the superintendent of the aquarium, says that in the waters, salt and fresh, within a radius of forty miles from the city there may be found perhaps a greater variety of fauna and flora than in any other like area in the world. All that life will in time be represented in the aquarium. Even at the opening there will be shown some wonderful and interesting fishes and other things from the waters hereabouts, such as are not popularly supposed to exist in this locality. There will also be exhibited migratory fish, representing other latitudes as well as our own, and a fine display of fish from Japan and Europe. The fresh water display will contain representatives from all over the globe.

When the aquarium is open, the larger part of the pools are to be stocked with amphibious animals, such as sea lions, seals, sea cows, turtles and porpoises, and there will be large fishes also, including perhaps sharks and sturgeons. The lower tier of wall tanks will be devoted largely to ordinary fish not more than three feet in length; the upper tier to a general variety of fishes. The labels attached to the tanks will give not only the common and scientific names of the fishes, but also colored pictures of them.

The water in the pools and wall tanks will be kept as nearly as possible at the temperature to which the fish were accustomed in their natural homes. The salt water used is taken from the bay; the fresh water is Croton, and all the water is filtered. The water in the pools and side tanks is constantly changing, and it may also be aerated artificially. The small glass tanks may be made self-sustaining by the introduction of just the right amount of plant life. It is not intended to make any special exhibition of marine plants, except so far as they are useful for the purpose of aeration in tanks where circulation would be undesirable.

Fish change their food more or less, just as human beings do, at different seasons, and migratory fishes change their diet also according to locality. When a fish from another clime comes here, he must be acclimated. It is not always possible to procure the food to which the fish has been accustomed, and it is difficult to make a fish change his diet. So he must be starved into it. Clams are the leading food, but some fish won't eat clams, and some that will eat them won't thrive on them. If the fish's appetite is poor, every effort is made to get something that he likes, such as shrimps, killies, or other small fish.

The fish in the aquarium are all more or less tame. Some of the biggest, weighing four pounds each, will take food from the hand, and there are some of that weight, game fish too, that would not resent being patted on the back. The seals, of which there are three handsome young specimens of about 100 pounds each, and three and a half feet in length, clamber up on the steps at the end of their tank and raise their noses above the rim in their eagerness for food. And when a fish is thrown to the other side of the tank they are off after it as a dog goes after a stick thrown into the water, except that the seals sometimes turn on their backs as they go.

THE EDIBLE TURTLES OF THE UNITED STATES.

THERE is not very much in American cookery, says a writer in the Revue Scientifique, that is of a nature to particularly tempt a European, and especially a Frenchman. The meat, poultry and game are not prepared in a very remarkable way, nor especially in a new one. It is only among the aliments of aquatic origin that there would be anything to borrow. The fish are abundant, varied and generally good, but the sauce is only passable. A good cook might turn them to some account. This, at least, is the result of a personal experience. The method of procuring the American species is not very complicated. It would require acclimations that seem to us to be perfectly realizable and an organization of pisciculture that we are far from possessing. For certain species, however, the thing is probably impossible, and such is particularly the case with the turtles.

The turtle cannot be considered as playing a great role in the American cuisine, by reason of its relative rarity, but it holds a well merited place in the preoccupations of the gourmet and serves as a basis for some excellent dishes. The variety of the natural resources of the United States as regards this category of alimentary reptiles is quite large, including, as it does, some forty species, terrestrial and aquatic.

The "loggerhead" (Thalassochelys cavetta) first occurs to us. This is found upon the Atlantic coast from Virginia to Brazil. It is a giant that weighs from 800 to 1,600 pounds, especially in the South. Those taken in Florida weigh, on an average, scarcely more than fifty pounds. It lives at sea and feeds upon various animals, but in April, May and June the female comes to the shore to deposit her eggs in the sand.

These eggs, which are from 150 to 200 in number, she places in a hole excavated for the purpose, and immediately covers with sand and leaves. The eggs form an agreeable dish, but the flesh is good only in the young individuals, since it becomes oily and acquires a musky taste in the adult. So the animal is hardly utilized except for the oil, the applications of which, however, are limited by reason of its odor. It serves particularly for coating the bottoms of boats, its odor preventing the attacks of the teredo and other perforating animals.

Two tortoise shell turtles (the Eretmochelys imbricata of the Atlantic and E. squamata of the Pacific) are more frequently used. They are smaller than the preceding species and the plates of their carapace furnish the well known and highly prized tortoise shell of commerce. The flesh is eaten, but not to a great extent.

It is the green turtles (Chelone mydas of the Atlantic and C. virgata of the Pacific) that furnish the greater part of the true turtle meat. These are the turtles par excellence. In the Atlantic they are met with from New York to Florida. Small at the North, they increase in size toward the South, passing from a weight of 8 to 15 and 20 pounds at Charleston to from 20 to 25 at St. Augustine, 35 at Halifax River, 50 to 60 at Indian River, and 50 to 100 at Key West. At Cedar Keys specimens have been found that weighed 600, 800, and even 1,000 pounds. They feed upon algæ especially, and zosteræ particularly, but in captivity are content with purslane. They often approach the mouths of rivers, where they appear to enjoy themselves. From April to June they repair to the shore in order to deposit their eggs. The Tortugas Islands, which are uninhabited, and which are visited only by wreckers and turtle fishermen, are one of their favorite haunts, but any desert beach of the coast is equally good for their purposes. The female creeps up on the shore two or three times, excavates a hole and deposits therein from 100 to 200 eggs (about 500 during the season), and returns to nearly the same place every time, and, on each occasion, covers the eggs with sand in order to conceal the site of the nest. The sun does the rest, but the sea birds devour many of the young ones, which, as soon as hatched, open a passageway to the exterior and betake themselves to the ocean. The flesh of this species is excellent, and forms the principal ingredient of green turtle soup; and the amateur will tell you that there is nothing so good as the "calipash," the flesh mixed with green fat that is found under the carapace. The yellowish "calipee" of the plastron is good, too, but the calipash is certainly better, either in soup or broiled. This meat is sold in the large cities, both in a fresh and preserved state. The price in New York in February is 15 or 20 cents a pound. Formerly, the turtle was taken by means of harpoons or spears, but this process injured the animal, and it is now taken in nets or captured upon the beach. Certain fishermen prefer to dive and take the animal by hand, but when the reptile is powerful this is not accomplished without some difficulty. It is in Florida especially that this fishery is carried on. At Key West it is pursued all the year. At Cedar Keys, it is carried on especially from May to October, with drift nets from 70 to 100 fathoms in length, that are placed on the surface in the vicinity of bands of turtles, which become entangled therein and are then taken without trouble. They are not all killed. If the fishing is good, and from one to six a day are taken per crew or boat, some are put aside and preserved in a living state in a crawl or inclosure at the sea side, whence they are taken and killed at the proper moment.

The genera Amyda and Aspidonectes furnish several small species that live in the rivers or fresh or salt water marshes, and that are much esteemed from a culinary standpoint. The snapping turtle (Chelydra serpentina) and alligator turtle (Macrolemys lacertina) are likewise esteemed, but the terrapins (Pseudemys) are better known, and figure alone with the green turtle upon restaurant bills of fare.

The terrapins inhabit fresh water and swamps, living partly on land and partly in water, and being rarely found above 41° of north latitude. The most esteemed are the Ps. rugosa, of the Delaware and Susquehanna and of the rivers emptying into Chesapeake Bay, and which may be seen in the vicinity of Washington; the Ps. mobiliensis, which is larger; and the Ps. scabra, which has a yellow plastron, and sometimes forms extensive bands in the bayous of Florida. But the queen of all is the Malacolemmys palustris or "diamond back," which inhabits brackish and saltish water from Massachusetts to Texas. This species, which is small, rarely exceeding ten inches in length, is very highly esteemed. The female attains a larger size than the male, but none is sold that is less than six inches in length, the minimum required in order that the commercial name of "counts" may be applied to them. The counts are at least six years of age.

Little is known as to what this species feeds upon, but, in captivity, fish, crabs and oysters are given to it, and these it readily accepts. It also takes certain vegetable food, such as celery. In winter it buries itself in the mud; but a small tumulus reveals its hiding place and renders it an easy prey. The female lays from 5 to 7 eggs in June or July in a hole dug in the sand. The flesh of this species figures upon the bills of fare of every restaurant of any importance, and is served as a stew. To stew it a la Maryland, the animal is thrown into hot water, and its shell and feet are removed. Then the liver and gall bladder are removed and the rest is cooked with eggs, butter, spices, milk and a little wine: but the gourmets of Philadelphia insist that the eggs of the animal itself shall be added. It is an expensive dish. In December the counts sometimes sell at $65 a dozen, and the largest individuals are worth over $90 per dozen. It is scarcely necessary to add that, under such circumstances, the terrapin fishery is very lucrative. Breeding farms have even been created for these animals, and when the fishing is good, some are put aside for the bad season. There are two or three of these installations upon the shores of Chesapeake Bay. They are large ponds at the water side which the water enters through the interstices between the stones, and keeps up a constant flux and reflux. The bottom is of mud covered with grass, and on the land side there is formed an artificial beach of sand, to which the females can resort in order to deposit their eggs. Care is taken to stretch nets horizontally in order to prevent the depredations of rapacious or sea birds. The young are placed in boxes with straw and kept therein until they are capable of entering the water.

They are preserved for about six years, and are fed twice a week upon crabs and fish. One of the best known of these farms is located on Hog Island, on the coast of Virginia. It has a superficies of about two acres.

In winter the adults bury themselves in the mud. This sort of exploitation does not require much technical knowledge, and gives very good results. Thanks to these farms, the market is supplied in all seasons, and the prices, as may be seen, depend upon those who are in competition.

Terrapins seem to enjoy a remarkable longevity. The Havre de Grace Republican, in August, 1893, mentioned a turtle that a Mr. Osborn found in his garden with the mark "A. O. 1828" cut in its shell. These initials were those of an uncle of Mr. Osborn. It may be admitted that the terrapin in question had reached its sixty-fifth year, a very respectable age.

Terrapins are taken in winter by means of the dredge, and also with apparatus analogous to those used for catching lobsters. At Beaufort and Wilmington another process is employed for the capture of the swamp terrapin: The grass is set on fire, and the terrapins, buried in the mud, "imagining that spring has arrived," come out of their retreat only to find themselves cruelly disappointed. At Roanoke Island dogs are employed. The dog runs along the beach, and as soon as he scents the tracks of a female that has come out of the water to deposit her eggs he barks. The owner comes up, takes the turtle and sends his quadruped off on a hunt again. There is here a very fine terrapin farm of two acres that contains from three to six thousand turtles.

THE AUSTRALIAN RABBIT PLAGUE.

MEN have been canonized for a variety of reasons—some more worthy than others. There is, or was, a man who, could his name be ascertained to-day, would receive a left-handed canonization by the general acclamation of at least four millions of his fellow men. He may have done it innocently; he may have done it thoughtlessly; he may even have done it with the best intentions—but he introduced wild rabbits into Australia! It is certain he could not have dreamed of the results, as even now the mischief he has wrought can hardly be comprehended by the rest of the world. What he actually did was to risk the destruction of a continent.

Less than thirty years ago some one, happily unknown, set at liberty in the colony of New South Wales and in the south island of New Zealand a few English rabbits. He is supposed to have done this for sporting purposes. It was several years before much notice was taken of the new colonists. Then, little by little, the rapid increase of the newcomers began to be talked about. Runholders in southern New Zealand were the first to feel the scourge. So rapid was the increase of the evil after this that within a year or two it became the subject of a parliamentary inquiry in the colonial legislative assembly. The runholders, who generally lease their land from the State, represented that if the new plague continued to increase at the same rate for a very few years, the state property would be almost, if not quite, valueless as sheep runs, and would, therefore, bring in no rents. The colonial legislature took alarm and was both prompt and decisive in its action. A law was at once passed to compel each landowner or leaseholder, under heavy penalties, to destroy the rabbits within proclaimed districts. Various plans were adopted, but the one found most successful in New Zealand was to keep packs of trained dogs to hunt the rabbits. This was carried so far that on one large run no fewer than 240 dogs and a considerable staff of men were maintained for some years until the evil was greatly reduced. Some owners introduced ferrets, weasels and stoats for the same purpose, but the legislature interfered to protect the birds of the country by preventing these animals being set at liberty. With energy and enterprise which, among the colonies of Australasia, are characteristic of the people of New Zealand, a use has been found for the rabbits, large quantities of which are now canned in various forms for market, while their skins are exported in quantities that give an idea of the extent of the plague. Last year the export of rabbit skins was officially reported as between seven and eight millions. These are said to be worth about two cents each.

The rabbit plague was a well established evil in New Zealand before it attracted any attention in Australia, and there are persons who assert that the furry invader was introduced from the island colony. This, however, seems hardly possible. It is now but little more than twenty years since the evil began to make itself felt in Australia. New South Wales is believed to have been the first seat of the mischief, but even this is not certain. One thing is not at all doubtful: that within two years of the first note of warning the new invasion had already become a public danger in both the colonies of New South Wales and Victoria. Efforts were at first made to deal with the danger by private enterprise, as in New Zealand. A class of men, rabbit catchers by profession, proposed to deal with the army of rabbits by contract. A short experience served to show that this proposal was a total miscalculation of the forces arrayed on the two sides. Applications were made to the parliament of New South Wales, and afterward to those of other colonies for help in the struggle, and the danger was so great that large sums of money were freely granted. Subsidies were given to the runholders, who are, in nearly every case, leaseholders of the state lands, to meet an equal expenditure by them in the destruction of rabbits. This continued for several years, but in the end proved nearly useless. The evil was that while one runholder spent money in destroying the rabbits, his neighbor gave up the struggle and allowed the run to become a

breeding ground for the animal. Runs that are practically in the hands of banks and loan companies as mortgagees are only too common in Australia; and on such runs the nominal owner had little heart to engage in so expensive and protracted a contest. Meanwhile the enemy advanced literally by leaps and bounds. One district after another became infected; large areas of country were regarded as hardly worth occupying, as the sheep would scarcely feed and certainly would not thrive on lands once overrun by rabbits.

Experience seemed to show that men could not cope with rabbits on land once overrun, and this led to the policy which has since been adopted of endeavoring to meet the evil mainly by exclusion. Owners and pastoral occupiers within proclaimed districts are required to erect fences capable of excluding rabbits, while the government itself has expended large sums in the erection of fences to separate clean from infected districts. Where these have been erected in time and sufficiently guarded afterward they have greatly retarded if not actually stopped the advance of the invaders; but it has often happened that the enemy has turned the flank of the position, and while the fence was still unfinished, the enemy's van has been found to have passed the line and occupied the country in the rear. In such cases there was nothing to be done but to take up a new line of defense.

Other means were also tried to deal with the evil. Some years ago a government reward amounting to $125,000 was offered to any one who would discover a plan by which the plague could be effectually ended. Many suggestions were made, but the one which created the greatest confidence was that of Pasteur. His proposal was to destroy the rabbits by the introduction of the epidemic disease known as chicken cholera among them. The great reputation of Pasteur induced the government of New South Wales to expend a large sum in testing the alleged discovery. An island fully stocked with rabbits was given up to Pasteur's assistants, two of whom were sent out by him to demonstrate the value of his scheme. For a time great hopes were entertained that the problem was about to be solved, and that to science rather than brute force Australia was to owe her deliverance from the rabbit invasion. The results failed to justify these expectations. Rabbits were inoculated, rabbits were undoubtedly infected by the inoculated ones; many rabbits died; but, unfortunately, many also recovered, and these appeared to be thenceforth proof against the disease. The final report of the commission was unfavorable. Science had so far failed.

This practically is the situation to-day. The rabbit invasion has been successful over large districts in the colonies of New South Wales, Victoria, South Australia and to a small extent in Queensland. It is even said that of late the rabbits seem to be following Eyre's famous starvation track into the vast colony of Western Australia. A good deal has now been done to check the advance toward the more settled districts of these colonies. Nothing has yet been done to put an end to the rabbit plague itself.

Climatic influences have undoubtedly been the all-powerful allies of the invaders in this struggle. Wherever these have been the most powerful, the attack has proved most irresistible. The climate of the southern zone of the continent appears to suit the rabbits best. So far they have shown little tendency to direct their march far enough to the north to enter a semi-tropical climate, but the sub-tropical regions appear to suit them only too well. In southern New Zealand, where the climate, although mild compared with that of all but the very south of England, or the greater part of this country, can still boast of some cold weather, and even of an occasional frost, the efforts of the settlers are capable of keeping the rabbits within bounds. On the Australian continent, in the region which the animal has selected for his special operations, no such checks exist. There are there no severe frosts; no snows to interfere with the search for that food, the growth of which is never entirely arrested by winter weather; nothing to check the appalling fecundity of the animal. The females, it is said, produce at least twelve litters of young in each year, and the young females become breeders themselves four or five months after birth. The result of this unchecked production may be imagined in a country of grassy plains, occupied only by herds of sheep or droves of cattle, and inhabited so sparsely that there is only a small fraction of a human being to each square mile of country. The rabbit invader has only one climatic enemy to fear in Australia, that is the recurrent droughts of the country. In a great drought the rabbits undoubtedly perish. The last severe drought in New South Wales was that of the years 1884, 1885, 1886, and some rabbit-infected districts were for the time cleared by its effect. In the same colony, and largely in the same districts, not fewer than three millions of sheep, and perhaps a quarter of a million head of cattle, also fell victims to the same drought. By the time the ranks of the thinned flocks were again filled up, the muster roll of the rabbit battalions was already as full as ever.

The great extent of the country and the nature of its occupancy, for as yet it can hardly be called a settlement, are the two factors which mainly go to cause the difficulty of the rabbit problem. In the vast district lying between the 29th and 38th parallels of south latitude—a district which roughly measures about 2000 miles by a breadth of 500—the country is either very scantily occupied or not occupied at all. Its great plains, corresponding in many respects to the prairie land of this continent, are held almost entirely by squatters or runholders, who use them only as a feeding ground for vast flocks of nomadic sheep or still more nomadic cattle. The squatter has indeed his home station—very often a little paradise of its kind—situated in some favored valley, or perched on the sheltered slope of a wooded range, overlooking a wide stretch of country all his own. There he has his home paddocks, where he breeds horses for the Indian market. Here are his shearing sheds, his garden, perhaps a vineyard; but outside this charmed ring fence he builds nothing, except it may be two or three great water tanks as a provision for a time of drought. He does nothing, and, indeed, he could do little. On a run, which may mean anything from fifty thousand to three or even four hundred thousand acres, it is no easy matter to suggest a plan of campaign by which the squatter can hope to wage a successful warfare with his enemy. On a run of the largest size he might keep from forty to fifty regular hands employed as overseers, boundary riders, and shepherds, and men at the home station; but were all these employed in hunting rabbits, their efforts could not possibly make any impression upon so wide a field.

Up to this time the policy of fencing out the invading rabbit is the only one that has yielded anything like a satisfactory result. The material employed is galvanized wire made with a mesh sufficiently fine to exclude even young rabbits. Such fences now extend for many hundreds or thousands of miles between infested and uninfested districts in several of the colonies. These are the outposts of the warfare that is waged daily between the human occupier and the invading rabbit; and the conflict is fierce as well as unceasing. There is no idea here of reaping any profit, or even of rescuing some small compensation. No one dreams, in Australia, of making use of the flesh, or even of preserving the skins. The war is one of simple extermination, and the fierceness of the struggle makes the mere destruction of the lives of the enemy the one thought of the party attacked. To kill the invaders—only to kill them by all or any means—is the watchword of the conflict in Australia. No one shoots them; nobody hunts them with dogs; both these methods have long since been abandoned as no better than a waste of time. The system of trapping, however, in some districts, has become general, and has undoubtedly done something toward thinning their numbers and checking their advance.

The Australian rabbit trap is essentially part of the rabbit fencing out policy. A rabbit proof fence is intended not only to prevent the animal crossing the line above ground, but also to prevent him getting through by means of burrowing. With this object it goes a few inches below the surface, and experience so far shows that this is sufficient to prevent the enemy from making any attempt to carry the line of defense by sap. This, no doubt, arises from the rabbit's want of knowledge of its own powers. Nothing could, of course, be easier than to run a mine below the fence, if only it possessed the required intelligence; but as a matter of fact, the rabbit burrows only to form habitations, and not to get from one place to another. Had it been otherwise, it would have been vain to fight for the possession of the Australian runs. Here and there indeed a burrow begun on one side of a fence comes out on the other, but only rarely and by chance. The army of invasion surges up against the barrier; tries to force a passage, tries even to leap over it, and, failing in this, surges back again. The pressure, however, is always greatest at the barrier, and this fact suggested the Australian rabbit trap.

When a fence is made, rabbit pits are generally constructed at regular distances along it, generally every three or four hundred yards. The mode of construction is simple. A pit is dug just inside the fence, and is, perhaps, eight feet long by four or even five feet broad. It is usually about six feet deep, and is roughly covered with boards. Entrance to the pit is afforded by an opening left in the fence close to the ground. This opening leads on to a short plank, so hinged that as soon as any weight is put upon it beyond a certain point it tips up, shooting whatever is upon it into the pit below. By this simple means vast quantities of rabbits are trapped day and night. It is the duty of each of the boundary riders to visit each morning the pits in his own district and destroy the rabbits he may find there, as well as any other noxious animals.

It is no uncommon thing to find nearly a hundred rabbits in one of these pits in the morning, but an Australian trap is no respecter of the person of any sort of animal. A stranger present at the morning jail delivery of one of them might be pardoned if he made the mistake of supposing he had come by accident upon a small menagerie in a somewhat disorganized condition. Upon first opening the man hole and looking into the dimly lighted pit he would be puzzled to account for the moving, struggling, leaping mass of life that would be the first thing to meet his gaze; and it would be several minutes before he could understand the meaning of the commotion. Rabbits he will see in plenty, bounding, leaping, skurrying into every corner and out again in the wildest terror; but there are also other animals. There is the mild-faced wallaby or small kangaroo, stupidly terrified at his close quarters and numerous company, and trying vainly, by an occasional clumsy jump, to avoid the unaccustomed sensation of having his tail trodden upon by his companions. There is probably a contingent of wildcats, surfeited, indeed, with rabbit meat, but still glaring fiercely at the frightened creatures. In the corners are a collection of small furry creatures, native rats, bandicoots and others bearing strange native names, but one and all having the true aboriginal brand of the marsupialia, black rats, brown rats, striped rats, moles and other mole-like animals, from the size of a small rat to that of a large cat, but every one harmless, and every one furred and pouched. Possibly there may even be a native bear, a simple, silly-looking animal about the size of a fairly large dog, with thick fur and clumsy limbs, slow of gait, and a face that looks out sheepishly with a faint surprise from the mat of shaggy hair that overhangs it.

More certain than any other occupant of the rabbit trap, except the rabbits themselves, are the lizards. Lizards of all sorts and sizes abound in Australia, from the thirty-feet-long crocodile to the smallest and most graceful of toy lizards; great and small, timid and fierce, beautiful and hideous, they abound in all places, and apparently under all conditions, and it would be strange if a rabbit trap were opened without disclosing among its occupants representatives of half a dozen kinds at least. Most certainly of all, the iguana will be found there. The iguana—popularly, and therefore beyond appeal, known by the name of the "goanner"—is, if not the natural, at least the most untiring enemy of the rabbit in Australia. What the queer, ungainly creature found to live upon before the rabbit invasion it would puzzle the most experienced to say, but at any rate, for him it must have been a happy day when they arrived. That he caught stray bandicoots, not unlike marsupial rabbits after all, in their unwary moments is probable enough; that he dragged himself up trees by an almost super-lizardean exertion of his claws in search of opossum is a fact too well attested to be denied, although a glance at his thick body, from four to five feet in length, and thick and clumsy in proportion, might excuse a doubt; but at best his life was a hard one. Since then times have changed, and should the acclimatizer of the Australian rabbit have earned the gratitude of no one else, he has at least deserved well of the "goanner." Now the iguana has more to eat than even a lizard's heart can wish. Now he gets his food without painfully dragging himself up trees or lying long in wait. He has but to walk into a rabbit trap any night with the certainty of a feast, and a speedy and respectful release in the morning.

Last, but not least, certainly not least in number, the trap is sure to contain a choice assortment of snakes; snakes black, brown, spotted and striped, snakes large and small; venomous and harmless, who, like the wild cats and the iguanas, have come in to supper or breakfast in the banqueting hall provided by man, to partake of the feast furnished by the rabbit.

The boundary rider's treatment of his very mixed company is business-like and unceremonious. Grasping his short-handled and heavily loaded stock whip where the long lash joins the two-feet-long handle, he winds the thong round his hand and without a moment's hesitation jumps through the man hole into the pit below. The new interruption causes additional confusion. Rabbits, bandicoots, native rats, and all the furry tribe scuttle off into the furthest corners, more alarmed by the new arrival than even by the presence of their more natural enemies. The wallabies hop clumsily out of his way. The wildcats rear and bristle and spit horribly at the intruder. The snakes uprear their crests and hiss a venomous welcome. Even the iguanas back a little before him and show a formidable array of teeth set in a crocodile jaw, with a very fierce and ugly snarl.

The boundary rider's measures are prompt and decided. He has other pits to visit this morning, and has therefore no time to fool around with snakes or lizards, great or small. To strike swiftly and surely to right and left at the threatening snakes is, for his practiced hand, the work of a moment, and in an instant they are writhing with broken backs on the ground, where, if they seem to be of venomous kinds, he crushes their heads with the loaded butt of his whip. The iguanas are rather more troublesome, as they are privileged animals, sacred from injury, owing to their qualities as rabbit destroyers. They are, in fact, by far the most annoying of his visitors. They must be released, and yet they are not safe to approach for that or any other purpose. They are combative, and their bite is a bad one, as it involves somehow drawing the teeth backward, thus inflicting a severe lacerated wound difficult to heal.

The intruder probably attends first to the other animals, only frightening the big lizards out of his way by a show of hostility with his whip, and proceeds to deal promptly with the miscellaneous contents of the trap. The wildcats may, if they choose, escape. They, too, live on rabbits, and consequently have their value. They are, however, fierce and aggressive, and not unfrequently bring doom upon themselves by a mistaken opposition to one not accustomed to delays. Your boundary rider is essentially a man of his hands, who stands no nonsense, and, excepting his horse and dog, makes no pets.

Stupid native bears, bandicoots, rats, and even wallabies, have no charms for him, except what may lie in the price of their skins in the Sydney market. For these they are ruthlessly sacrificed, and having disposed of them, the real business of his visit is proceeded with. The rabbits—large gray rabbits they are, somehow not exactly like their English progenitors, for natural variation is a rapid thing where rabbits are concerned—are easily reached in so small a space. The work is soon done, and the heap of bodies is contemptuously thrown up through the manhole. A board provided for the purpose is then placed against the side of the pit, and the iguanas are driven out, not always without a struggle.

Such is the daily routine of the frontier warfare between the settler and the invading rabbit, and, as it stands, it can hardly be considered a very hopeful one. It is true that the rabbit fence has gone far to check the advance of the plague, and could it continue equally effective, it might even in time solve the problem. Its value in future is doubtful. It is possible that in the stern school of necessity instinct may come to the assistance of the invaders and teach them the lesson of carrying the defenses by sap. There is even a rumor current that in some districts natural selection is endowing individuals with longer and stronger claws than nature formerly allowed to the race, by means of which some have been surprised in the very act of carrying the fences by escalade. This probably is an exaggeration due to an imaginative temperament acting upon ill-digested doses of the Darwinian theory, but without it the risk is great enough. On the other hand, there is a hope that if the rabbits can be kept back for a few years, the evil may die out from natural causes.

It seems a fact that a country fully stocked with rabbits soon becomes what is locally known as "rabbit sick." In such country disease of an unknown kind seems to spread with a rapidity that is amazing, sweeping large districts almost clear within a few weeks, as if by magic. In districts thus cleared, even if a few remain, they appear to have lost their vitality, and gradually disappear. Whether the cure would be a permanent one there has not yet been time to ascertain; but it is the general opinion in the country that if the rabbits can only be prevented from spreading into new pastures, they will quickly die out, or at any rate cease to be a menace to the country.

There are, of course, and for many years to come there will remain, the vast and almost unexplored regions of central Australia, into which the rabbit might penetrate unmolested by man. This, however, would hardly appear to be a serious danger. Up to this time the rabbit has shown no disposition to spread into the more tropical regions. Even should he grow acclimatized to a hotter climate, the drought of the interior and the great distances between water supplies, except those artificially created by means of artesian borings, would render the country very unsuitable for its speedy increase.

It may be said that the rabbit plague of Australia is, after all, but a temporary scourge, and that when it has once swept across the more temperate regions of

the continent it will disappear. This may be true; but for the present the process is a painful one. The wealth of Australia, which, in proportion to its population, is said to exceed that of any other country in the world, is, with the exception of its mineral treasures, mainly the produce of its vast pastoral areas. In New South Wales alone, with a population of only twelve hundred thousand souls, there are about sixty millions of valuable sheep and two millions of cattle, and the exports of wool, skins and tallow from these was, last year, worth fully $60,000,000. These facts are alone sufficient to show how disastrous anything would be which even for a time interfered with its pastoral prosperity.—N. Y. Sun.

PERILS OF MODERATE DRINKING IN FRANCE.

WHILE French writers, like those of every nation, have never been slow in denouncing occasional or habitual drunkenness, few have been found in France, that country of wines and liquors, to utter words of disapproval for the habitual moderate drinker. A noteworthy exception to the general rule is Prof. L. Capitan, of the School of Anthropology, at Paris. In the latest issue of the Revue Mensuelle de l'Ecole d'Anthropologie de Paris, he has a study of the subject, which we present. He says:

"The social influence of alcoholism is now considerable. Still, that influence cannot be perceived at a first glance, but requires careful attention. When, however, the matter is patiently watched, the proof of such influence is irresistible. I must begin by noting that in society it is not the alcoholics who have reached an advanced state of intoxication that can have any influence whatever, but, on the contrary, the alcoholics in a state of evolution, who, in their conduct, in their family and general life, when closely observed, are found to conduct themselves in abnormal ways.

"For convenience of description, two periods or forms of alcoholism may be considered: The phase of excitement and the phase of depression. These phases may be manifested by symptoms that are intense or, on the contrary, quite slight.

"In regard to the phase of excitement, it may be noted that a little dose of alcohol or alcoholic drink may produce an excitement which is sometimes useful. If, however, the dose be repeated habitually and increased, as generally it is, this phase of excitement, even before ending in unconsciousness, may produce grave troubles in the psychical functions. In this way, little by little, the character of the drinker is altered. He becomes more easily acted on by outside influences. Sometimes gayety is his dominant note, more frequently sadness. Thus he will manifest a special condition of irritability, an exaltation of his instincts, sometimes good, but more often bad. From this it will result that his perceptive faculties will be clouded, and naturally his judgment also. On the other hand, this state of irritability causes the subject of it to act suddenly, on the spur of the moment, without any sufficient consideration. He complains incessantly, is irritated by the slightest thing, rebels against all authority. Moreover, while the alcoholic is very easily acted on by influences outside of himself, he as easily becomes the victim of his own suggestions. The effect of imitation grows stronger in him. To sum up, the alcoholic, in this phase of excitement, manifests a certain incoherence which may be more or less marked, a note of excessive psychical excitement that a careful analysis makes it possible to recognize among alcoholics, even at the beginning of their evolution.

"The phase of depression may immediately follow one of the states of excitement of which I have just spoken, or occur unexpectedly. The characteristic of this phase is a general lassitude, a sensation of fatigue, of being ill at ease, a need of repose and with that a marked moral depression, a complete want of energy and force of reaction. From this results a series of states of the psychical functions, precisely the reverse of those just indicated as belonging to the phase of excitement. The alcoholic in this condition feels disgust for his work, he loses his skill, becomes lazy. He has no longer a healthy perception of things nor a capacity for careful consideration. Thus he manifests incoherence in his acts and conduct, he complains constantly, is never satisfied; he suffers, and it is his own fault.

"The social consequences of the particular states of cerebral function I have just indicated, so variable in alcohols, are grave. The alcoholic not infrequently loses his situation, becomes incapable of serious labor, wastes his time and his money, and, increasing his dose of alcoholic drinks, ends by becoming one of the class of drunkards, more or less habitual.

"The effect of the alcoholism of which I am treating is deplorable in the family. Its head, with his nerves more or less in a constant state of irritation, though he refrain from all violence and treat his wife and family decently, still keeps his household constantly in a disturbed and uncomfortable condition, which cannot fail to affect unfavorably the character of those growing up round him.

"In society the alcoholic person plays a part not less to be deplored. He is a bad citizen, either because he is constantly in conflict with authority and in a state of revolt with everything that does not suit the humor he may be in at the moment from the perturbed state of his nervous system, or else, inversely, at the time of reaction, he passively acquiesces in whatever suggestions may be made to him. How large a share these defects have on some of the evils which afflict society, only those can tell who have studied the subject long and patiently.

"Is there any remedy for this evil? Some good people think so, just as there are those who believe that you can stop a torrent or bar the way of a rising tide. These are generous illusions shared by eminent men. Thus it is that M. Aiglave is convinced that, if the monopoly of alcohol belonged to the state, it would be able to regulate alcoholism and force it to run in a certain channel. Others claim that by raising the tax on alcohol and lowering that on wines and cider, you can reach the same end. This has been recently proved to be a hypocritical theory. Still others maintain that a rigorous application of the law against drunkenness would be useful. Moral treatment of alcoholics, amelioration of the condition of working people, are but feeble means and difficult to make efficacious. The result of all these fine theories is that alcoholism increases incessantly.

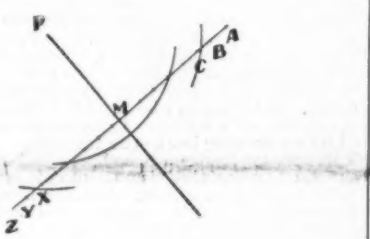
"Of one thing we may be certain, that the state, to which alcohol brings an average revenue of some fifty millions of dollars a year, will never have the strength or the courage to restrict in any considerable degree the consumption of alcohol. Nevertheless, that would be a good stroke of business for the state, since alcohol, by the number of crazy people that it produces, by the diseased persons who, solely by reason of the use of alcohol, incumber the hospitals, by the citizens it kills, is the cause of a large pecuniary loss every year to the state. The large sum thus lost would be saved by diminishing the consumption of alcohol.

"There are other considerations that might be noticed, but it is time to conclude, which I do by saying that alcoholism, one of the gravest social maladies, attacking all the organs of the alcoholic, interfering with both his physical and psychical functions, reaching all classes of society, is a very great social danger. If its march is ever arrested, it is with the habitual moderate drinker that the improvement will have to begin. It is something to know the gravity and extent of the evil I have endeavored to portray."—Literary Digest.

AN EASY WAY TO MAKE A NOON MARK.

By Rev. EDWARD RIGGS.*

SELECT a smooth, horizontal surface, as the well planed floor of a veranda, opening toward the south. Borrow a carpenter's spirit level and make sure that your surface is substantially horizontal. The floor of a room will answer, if a window opens pretty nearly toward the south. Suspend a plumb line at a point, P, where its shadow will fall on your horizontal surface through a considerable part of the day. Secure this in its place so that it shall not sway, taking care that you do not vitiate its perpendicular position. Fasten a small object, as a small button or a knot of string, on your perpendicular string, at any convenient point where you can watch its shadow. Some sunshiny day, when you are at liberty to attend to it for a little while both morning and afternoon, mark with a pencil point the center of the shadow of your button. Do this at half a dozen different times before noon (A, B, C, etc.), at intervals of say half an hour, or a quarter of an hour, making the intervals about equal, and do the same in the afternoon (. . X, Y, Z). The series of dots may be continued through all the hours that



the shadow is falling on the surface, but the essential thing is to have a set of three or four points in succession at some time during the forenoon, say about nine or ten o'clock, and another set at about the same length of time after noon, i. e., at about two or three P. M. Join these dots by a carefully drawn line. You will find it very nearly a straight line. Now, from the foot of your perpendicular as a center, draw arcs with any convenient radius, cutting your dotted line in two places. Bisect the chord that joins these two points of section, and join the middle point, M, of the chord to the foot of your perpendicular. This line, NP, will be a true north and south line, and when the shadow of the perpendicular string falls on it, it will be solar noon. From this, by reference to the noon mark column in an almanac, you can get exact mean time.

If it is not convenient to keep a string permanently in the position of your plumb line, select a perpendicular edge that will cast a sharp shadow at noon, as the edge of a square pillar of the veranda, or one side of a window frame, and after satisfying yourself that it is fairly perpendicular, draw exactly from the foot of it a line just parallel to your north and south line, and then the shadow of your solid edge will fall at solar noon.

By comparing the magnetic compass with your north and south line, you will be able to observe the amount of the variation of the former, for your particular locality.—Popular Astronomy.

DEODORIZING RECOVERED ALCOHOL.

By EDWARD A. KADEL.

HERE is a method that, with slight modifications, gives splendid results in my hands. I have not as yet found an alcohol so vile that I failed to purify it, so as to render it fit for employment in general manufacturing.

The alcohol is first treated with caustic soda; for alcohol recovered from drugs like arnica, buchu, cubebs, etc., one ounce to each gallon is employed. After standing for two to five days it is distilled in a water bath or steam-jacket kettle. The alcohol first passing over must be returned to the still. This is continued until the odor is either changed or lost. Usually this distillation leaves an empyreumatic and sometimes a soapy odor to the alcohol. It is then redistilled with potassium permanganate; the quantity to be used can be determined by experience alone, alcohol recovered from the same drug at different processes requiring different proportions; usually one to four drachms to a gallon is employed. Thus treated, it is generally clean enough for re-employment for manufacturing purposes, seldom producing any coloration with hydric sulphate. If further purifying is desired again, distill with the permanganate and filter through animal charcoal, but unless the charcoal is freshly prepared, this is useless. If I have not fresh charcoal, I add a small quantity of distilled water, and distill again after the second treatment with the permanganate.

From the standpoint of economy this process certainly is unobjectionable. I employ a five-gallon still of my own construction—a fair average of three gallons an hour by water bath being its working capacity. Time, gas and material, I find, are fully compensated for, and in laboratories equipped with steam, the cost of purifying is reduced to a minimum. The process requires no attention after it is once under way. I seldom go near the still after complete automatic action has been secured.—Indiana Pharmacist.

* Missionary in Turkey.

ERRATUM.

THE HORSE AS A HIGH SPEED ENGINE.

(SCIENTIFIC AMERICAN SUPPLEMENT, Dec. 1, 1894.)

Erratum.—Third paragraph from last, for 25, read 2·5; for thirty, read three; for an hour, read six.

These errors were checked in the original paper, but escaped correction in the copy sent to the printer.

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